THE NORTH AMERICAN TWO-WINGED FLIES OF THE FAMILY SIMULIIDAE

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Since the publication of J. R. Malloch's treatment of the "American Black Flies or Buffalo Gnats" in 1914[1], the collection of these insects in the United States National Museum has been increased several fold. The present publication is based on the material used by Malloch, and the additional material which has been collected mostly by Dr. J. M. Aldrich and the writers. Also material has been loaned us by J. S. Hine, the Illinois Natural History Laboratory (through T. H. Frison), the Biological Survey, and H. C. Hallock.

The generic arrangement here used is primarily based on a previously unused character, namely, the presence or absence of hairs on the second section of the radius (between the stem vein and base of the radial sector). Only 4 genera are here recognized, which is in sharp contrast to the 17 recognized by Enderlein. We have found Enderlein's classification entirely unsuited to the American fauna. Both *Eusimulium pecuarum* and *mutatum* which he places in the subfamily Prosimuliinae, a group based on the character of the forking of the radial sector, have the radial sector simple. In fact, he erected the genus *Cnepha* to contain these two species upon this particular character which, we have just mentioned, they lack. In practically all other instances where the American fauna is involved in his treatment we have found that the genera he proposed are too finely drawn and of no practical value.

The region included in the present work is the mainland of North America and Greenland. Forty-seven species and two races are recognized, of which we have more than 3,000 adult specimens. Mal-

[1] U. S. Dept. Agr., Bur. Ent. Tech. Ser., No. 26, 1914.

loch recognized 3 genera and 31 species for the same region, 5 of which are here considered as synonyms.

The chief differences between Malloch's and the present treatment are in the arrangement of the groups and species and the greatly extended distribution of species which the great abundance of material now at hand affords.

For specific differentiation, characters of the female hypopygium have been employed, as well as those of the male, which has enabled more accurate differentiation of some of the similar species.

Attention should be called to A. W. Jobbins-Pomeroy's publication.[2] Detailed accounts of the biology and figures of the larva, pupa, and male genitalia of *Simulium venustum*, *S. jenningsi (=venustum)*, *S. bracteatum (=E. aureum)*, and *S. pictipes* are given.

A. E. Cameron in a bulletin [3] gives a very extended account of the morphology and biology of *Simulium simile* Malloch (*=arcticum* Malloch).

In certain of the descriptions of reared species following, where the characters depend upon miscroscopic preparations, we have in some cases mounted more than one specimen of a series. In these cases the mounted specimens are designated as "types," the rest of the series which agree macroscopically, but have not been mounted, as "paratypes."

TABLE OF GENERA OF SIMULIIDAE

Radius setose on its entire length.
  Radius joining costa at middle of coastal vein; radial sector forked; antenna 10-jointed ---------- **Parasimulium** Malloch.
  Radius joining coastal vein far beyond its middle.
    Radial sector with long fork; hind basitarsus not produced apically; second hind tarsus without dorsal incision and much longer than width of basitarsus; front usually broad---------- **Prosimulium** Roubaud.
    Radial sector simple; hind basitarsus produced or not produced apically, second hind tarsus with or without dorsal incision and less than twice the width of the basitarsus; front narrowed---- **Eusimulium** Roubaud.
Radius bare between the stem vein and base of radial sector; radial sector simple; hind basitarsus produced apically; the second hind tarsus with dorsal incision and less than twice the width of basitarsus.
  Simulium Latreille.

Genus PARASIMULIUM Malloch

Parasimulium MALLOCH, U. S. Dept. Agr., Bur. Ent. Tech. Ser., No. 26, 1914, p. 24.

Very small brownish species; antennae 10-jointed, large, being longer than fore basitarsus and twice as long as the dorso-lateral thoracic sclerite. Front broad, widened above; clypeus very narrow,

[2] U. S. Dept. Agr., Bull. No. 329, March, 1916.
[3] Dom. Canada, Dept. Agric., Bull. No. 5, New Series, 1922.

about four times as long as broad; mesonotal pile short and fine, longer and coarser posteriorly; scutellum with long coarse pile, directed anteriorly; tarsi slender; hind basitarsus without projection; following joint without basal scale; costa, subcosta and radial veins with rather long hairs on dorsal and ventral surfaces; subcostal joining costa near basal third of costal vein; radius joining costal vein at its middle; radial sector forked; R_{4+5} joining costal a considerable distance before tip of costa; section of radius between stem vein and base of radial sector not longer than section of costa beyond R_{4+5}; fold between media and cubitus scarcely visible and apparently unforked; mesosternum flat, the semicircular portion barely discernible; abdominal tergites and sternites well developed, fully chitinized. Only one species, the genotype.

PARASIMULIUM FURCATUM Malloch

Parasimulium furcatum MALLOCH, U. S. Dept. Agr., Bur. Ent. Tech. Ser., No. 26, 1914, p. 24.

Antennae pale yellow, basal joint brownish; mesonotum dark brown; pleurae yellowish; legs yellowish, hind femora darker; abdomen dark brown; claws untoothed.

Only a single specimen is known for this genus and species, which in several respects appears to be the most generalized form known for the family.

Type locality.—Humboldt Co., Calif. Type in U. S. National Museum, Cat. No. 15403, U.S.N.M.

Distribution.—CALIFORNIA: Humboldt County, June 9, 1903 (H. S. Barber).

Genus PROSIMULIUM Roubaud

Prosimulium ROUBAUD, Compt. Rend. Acad. Sci. Paris, vol. 143, 1906, p. 519.
Prosimulium MALLOCH (part). U. S. Dept. Agr., Bur. Ent., Tech. Ser., No. 26, 1914, p. 15.
Prosimulium ENDERLEIN (part), Deutsch. Tierarzt. Woch., Hanover, 1920: Zool. Anz., vol. 53. 1921, p. 43.
Helodon ENNDERLEIN, Deutsch. Tierarzt. Woch., Hanover, 1920; Zool. Anz., vol. 53, 1921, p. 43.

Genotype.—Simulium hirtipes Fries.

Medium sized to large species, usually dark colored, sometimes yellow; antenna usually 11-jointed, sometimes 9-jointed; front usually rather broad, rarely narrow; clypeus broad, a little longer than its breadth; tarsi slender; hind basitarsus without apical projection; second joint without subbasal dorsal excision, elongate, being much broader than width of basitarsus; claws bifid or simple; subcostal joining radius at or a little beyond middle of costal vein; radius joining costa far beyond middle; R_{4+5} joining costal vein very near its tip; radial sector forked (that is, R_{2+3}, distinct from R_{4+5});

upper side of radial vein piliferous on its entire length; fold between media and cubitus distinct, forked; chitinization of tergites usually reduced, of the sternites usually much reduced.

KEY TO THE SPECIES OF PROSIMULIUM

Claws distinctly bifid (i. e., basal portion tooth-like); anal lobes of the female (below cerci) partially or not chitinized, with setae in a group.
Integument yellow; front at greatest width about half its length; only mesepimeron tuft present ..... onychodactylum, new species.
Integument black; front broader; three pleural tufts, viz, on anterior sternopleura, lower pteropleura, and mesepimeron ..... pleurale Malloch.
Claws not bifid.
Antennae nine-jointed with basal joints black; legs black; female anal lobes as in *onychodactylum* and *pleurale* ..... novum, new species.
Antennae 11-jointed; basal antennal joints yellowish; legs usually yellowish; anal lobes of female chitinized and evenly setose like the cerci.
Female ovipositor reaching tip of abdomen; anal lobes strongly produced and coarsely hairy ventrally.
Third antennal joint distinctly enlarged as compared with the second; large species ..... magnum, new species.
Third antennal joint not conspicuously enlarged, medium-sized species.
Stem vein dark pilose ..... dicum, new species.
Stem vein pale pilose ..... dicentum, new species.
Female ovipositor shorter and weaker; anal lobes evenly setose, not stronger ventrally; medium-sized species.
Integument yellow ..... fulvum Coquillett.
Integument black.
Male adminiculum evenly arcuate, broad, smooth ..... hirtipes Fries.
Male adminiculum ovate with narrow projecting center, the basal arms broad and lobed ..... exigens, new species.
Male adminiculum with lobed bifid center; basal arms detached. pancerastes, new species.

PROSIMULIUM ONYCHODACTYLUM, new species

A species that is quickly characterized by its brownish yellow integument; very narrow front, large antennae, yellowish legs, bifid claws. Ovipositor undeveloped, lips of opening membranous, not produced, spicular. Genital rod forked, limbs slender, weak outwardly but slightly expanded. Cerici rounded quadrate, wider than long. Lobes of last segment round, small, spicular, with a group of about 10 scattered setae; no chitinized area. (Figs. 10 and 11.)

Male and immature stages unknown.

Type locality.—Long's Peak, Colo.

Type.—Female, Cat. No. 28324, U.S.N.M.

Distribution.—Colorado: Long's Peak Trail, timberline, 11,000 feet altitude, August 28 (T. D. A. Cockerell).

PROSIMULIUM PLEURALE Malloch

Prosimulium pleurale MALLOCH, U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 17.

A species easily characterized by the bifid claws and the three pleural patches of pile.

Male and immature stages unknown. Ovipositor: Essentially as in *novum;* flaps rounded, slight spicular. Cerci transverse, twice as wide as long, strong, chitinized, setose. Tips of last segment very narrowly chitinized, the membranous ventral area large with a group of about six tubercles centrally, closely placed and bearing long slender setae. Genital rod widely forked, the arms very slender but widening to a strong, conical, outwardly dentate plate on each side. (Fig. 18.)

Four specimens at hand.

Type locality.—Kaslo, British Columbia. Type in U. S. National Museum, Cat. No. 15403, U.S.N.M.

Distribution.—ALASKA: Hurricane, July 15, 1921 (J. M. Aldrich). Camp 334, Alaska Eng. Com. July 9, 13, 1921 (J. M. Aldrich).

BRITISH COLUMBIA: Kaslo, June 18, 1903 (R. P. Currie).

PROSIMULIUM NOVUM, new species

In general appearance very close to *hirtipes*. Differs in having only nine joints to the antenna, the joints being unusually well separated and distinct; entire body, including antennae and legs, black; pilosity yellowish; stem vein with pale pile; squamal cilia whitish. Ovipositor, practically none; margins of opening membranous, curved, not produced backward. Cerci rounded, quadrate, not as long as wide; tips of last segment reduced, narrowly chitinized and setose above, rounded and membranous below, with a group of short stiff setae on large tubercles. Genital rod widely forked, the limbs first narrowed and black, then expanded into a large irregular chitinous plate. (Figs. 14 and 15.)

Length 4 mm.; wing 4.25 mm.

Apparently a mountain species. Specimens from Gospal Mountain, Idaho (J. M. Aldrich), bear labels "Bad on horses." Male and immature stages unknown. Forty specimens.

Type locality.—Two Medicine Lake, Montana.

Types.—Two females, *paratypes*, 30 females, Cat. No. 28325, U.S.N.M.

Distribution.—British Columbia: Kalso, July 5, 11, 1903 (H. G. Dyar).

California: Seneca, Plumas County, June 1, 1923 (V. S. Barber).

Idaho: Gospel Mountain, July 12, 1907 (J. M. Aldrich).

Montana: Two Medicine Lake, July 4, 1921 (H. G. Dyar). Belton, June 19, 1921 (H. G. Dyar).

Washington: Kitsap Lake, Bremerton, April 29, 1924 (H. G. Dyar). Hoodsport, May 3, 1924 (H. G. Dyar).

PROSIMULIUM MAGNUM, new species

The largest species in our fauna.

Female.—Closely allied to *hirtipes* but may be easily separated by its unusually robust appearance; two basal antennal joints yellowish, remainder dark; three basal antennal joints enlarged, remainder tapering to a point; fore tarsi more elongate, the basitarsus distinctly larger than antenna; stem vein pale pilose. Ovipositor: Much larger and stronger than *hirtipes*, reaching the tips of the last segment which are drawn out to equal the blunt cerci and strongly hairy. (Figs. 1 and 2.)

Male.—Essentially as in *hirtipes*. The spines on the claspers are much stronger and more widely separated than the *hirtipes* from the same locality (Figs. 22 and 23.)

Larvae and pupae were found by the junior author, April 12, 1925, in Dead Run, Va., a small stream that descends among rocks the sharp decline of the banks of the Potomac. The pupae project from an irregular, rather dense web on a leaf or stone where the water is swift, and are often densely crowded together. The pupal filaments are multiple-branched about 10 trunks, at the base of each tuft, which fork near the base, some fork a second or even a third time, the total number being 30–40.

Type locality.—Dead Run, Fairfax County, Va., from reared material.

Type.—Male, *allotype* female, *paratypes* 3 males, 2 females, Cat. No. 28326, U.S.N.M.

Fourteen specimens at hand.

Distribution.—Maryland: Plummers Island, April 19, 1903; April 28, 1909 (E. A. Schwarz, W. L. McAtee). Cabin John, April 28, 1912 (J. R. Malloch).

Michigan: Grand Ledge, April 28, 1912 (H. G. Hubbard).

Virginia: Great Falls, April 24, 28, 1915 (R. C. Shannon). Dead Run, April 12, 1925, April 19, 1914 (R. C. Shannon).

PROSIMULIUM DICUM, new species

Female.—Close to *magnum*. Antennae entirely dark; stem vein black pilose; body pile abundant and pale; legs dark or in part brownish yellow. Differs from *magnum* in being a little smaller; the darker basal antennae joints and smaller third joint a little broader than long. Ovipositor: Long, strong, sheaths darkly margined within, reaching near the end of the anal lobes. Cerci rounded quadrate, moderately sized, setose, and spicular. Anal lobes conically produced, reaching as far as cerci, sparsely setose above, densely and coarsely so ventrally. Genital rod down-curved at tip, forked, the arms short, with a short quadrate chitinous plate with produced angles. (Figs. 5 and 6.)

Type locality.—Hoodsport, Wash.

Types.—Two females, *paratypes* 3 females, Cat. No. 28327, U.S.N.M.

Thirty-five specimens at hand, all females.

Distribution.—ALASKA: Ketchikan, June 20, August 6, 1919 (H. G. Dyar).

BRITISH COLUMBIA: Prince Rupert, June 7–17, 1919 (H. G. Dyar).

WASHINGTON: Hoodsport, May 3–11, 1924, July 6, 1920 (H. G. Dyar).

PROSIMULIUM DICENTUM, new species

Differs from *dicum* in having stem vein pale pilose. The female anal lobes are more rounded, less coarsely hairy ventrally than in *dicum*. (Figs. 7 and 8.)

Type locality.—Truckee, Calif.

Type.—Female, Cat. No. 28328, U.S.N.M.

Distribution.—CALIFORNIA: Truckee, April 22, 1921 (H. G. Dyar).

PROSIMULIUM FULVUM Coquillett

Prosimulium fulvum COQUILLETT, Proc. U. S. Nat. Mus., vol. 25, 1903, p. 96.

The bright yellow color easily distinguishes this species in both sexes from all others of the genus except *onychodactylum* which has bifid claws. Female ovipositor weak, the cerci and abdominal tips as in *hirtipes* but weakly chitinized and pale. (Fig. 9.) Male genitalia as in *hirtipes*, except that the parts are weakly chitinized and pale brown instead of black. (Figs. 20 and 21.)

Fulvum is an abundant species in the mountainous regions, chiefly in the Pacific Northwest. It has been reported attacking man and animals. The immature stages remain unknown. One hundred and sixty-three specimens at hand.

Type locality.—Bear Paw Mountain, Mont. Type in U. S. National Museum, Cat. No. 6182, U.S.N.M.

Distribution.—Alaska: Camp 327, Alaska Eng. Com. July 13, 1921 (J. M. Aldrich). Cape Fanshaw, June 22, 1919 (H. G. Dyar). Fourth of July Creek, July 21, 1921 (Alice Twitchell). Juneau, June 22, 1919 (H. G. Dyar). Katmai, June 10, 1917 (J. S. Hine). Seward, June 26, 1921 (J. M. Aldrich). Sitka, June 16, 1899 (T. Kincaid). Skagway, June 3, 1919 (H. G. Dyar). Virgins Bay, June 26, 1899 (T. Kincaid). Savonoski, Novak Lake, July 19, 1919 (J. S. Hine).

British Columbia: Bear Lake, July 29, 1903 (R. P. Currie). Laggan, August 16, 1906 (Dyar & Caudell). Lake Atlin, July 23, 1919 (H. G. Dyar). Kaslo, June 29, 1903 (H. G. Dyar). South Fork Kaslo Creek, August 11, 1903 (H. G. Dyar). Kokanee Mountain, August 10, 1903 (A. N. Caudell). Mount Cheam, August 7 (J. Fletcher). Prince Rupert, June 7, 1919 (H. G. Dyar).

California: Fallen Leaf, Lake Tahoe, June 18, 1916 (H. G. Dyar). Gold Lake, Plumas County, July 22, 1916 (H. G. Dyar).

Colorado: Custer County (T. D. A. Cockerell).

Idaho: Moscow Mountain, June 19–July 10, 1920 (A. L. Melander).

Montana: Belton, June 21, 1921 (H. G. Dyar). Glacier Park, July 1, 1921 (H. G. Dyar). Two Medicine River, July 27, 1921 (H. G. Dyar). Bear Paw Mountain, September 3, 1891 (H. G. Hubbard).

Oregon: Crater Lake, July 30, 1920 (H. G. Dyar).

Washington: Glacier, June 4, 1917 (H. G. Dyar). Hoodsport, May 31, 1924 (H. G. Dyar). Mount Ranier (M. W. Lyon, jr.). Lake Cushman, June 27, 1917 (H. G. Dyar).

Yukon Territory: White Horse, July, 1919 (H. G. Dyar).

PROSIMULIUM HIRTIPES (Fries)

Simulia hirtipes Fries, Mono. Simul. Suec., 1824, p. 17.

Female.—A rather variable species. Integument black: front rather broad, distinctly narrowed below, covered with loose pale pile; antennae 11-jointed, two basal joints yellowish or brown; thoracic pile usually yellowish, but ranging from whitish to blackish; legs largely yellow, black rarely predominating; fore basitarsus as

long as antenna; claws not produced basally; chitinous plates on segments 3, 4, and 5 distinctly reduced in width; all but the last sternite completely membranized; stem vein pale pilose. Ovipositor: Rather broad and large but thin and not produced backward, the valves broadly brown chitinized within, strigate spicular. Cerci quadrate, nearly twice as wide as long, anal lobes conical, as long as the cerci and like them evenly setose and spicular. Genital rod forked, each arm with short chitinous plate with produced corners. (Figs. 12 and 13.)

Male.—Pile much longer and usually darker: chitinization of tergites and sternites not greatly reduced. Hypopygium, side piece cylindrical, slightly tapered, a little longer than broad; chitinous wall cut out on each side leaving a basally directed point with narrow bridge. Clasper short, conical, setose with two terminal short claws. Adminiculum broad, smooth, minutely pilose; no teeth on adminiculum arms.

Prosimulium hirtipes (Fries) originally described from Europe is widespread in Europe and North America. In America it appears to be confined to the region east of the Mississippi and north of the Carolinas. There are allied species found in the West. Is is an early spring species. In the vicinity of Washington it may be found as early as March 18 and as late as May 23. *P. hirtipes* attacks man rarely and does not appear to be a severe pest to livestock. One hundred specimens at hand.

Type locality.—Unknown. Location of type unknown to us.

Distribution.—CONNECTICUT: Roxbury, May 6, 1885 (E. W. Lendewey).

DISTRICT OF COLUMBIA: Washington, April 4, 1895 (E. A. Schwarz).

LABRADOR: Hawks Harbor, July 20, 1908 (Peary's North Pole expedition).

MAINE: Mount Katahdin, 3,000 feet, August, 1902 (———).

MARYLAND: Plummers Island, April, 1915 (R. C. Shannon). Cabin John, April 28, 1912 (J. R. Malloch). South Mountains, April 12, 1916 (H. L. Parker). Forest Glen, May 23, 1915 (O. Heidemann).

MASSACHUSETTS: Melrose Highlands, April 23 (D. H. Clemons). Holyoke, April 12, 1903 (F. Knab).

NEW FOUNDLAND: Balena, June 1903 (W. Palmer).

NEW HAMPSHIRE: Berlin Falls, August 10 (———). Franconia (A. T. Slosson). Hermit Lake, White Mountains (S. H. Scudder).

NEW YORK: Wilmot, June 1–15, 1887 (J. H. Comstock). Adirondack Mountains, Mount Seward, 4,500 feet, June 22, 1901 (A. D. MacGillivray). Ithaca, May 22, 1901 (O. A. Johannsen).

VIRGINIA: Maywood, April 21, 1916 (W. L. McAtee). Scott's Run, April 11, 1912 (W. L. McAtee). Dead Run, March 18–April 19, 1914–1916 (R. C. Shannon). Great Falls, April 3, 1922 (H. S. Barber). Vienna, April 18, 1915 (W. L. McAtee).

PROSIMULIUM EXIGENS, new species

Close to *hirtipes*. Antennae entirely blackish; third joint broader than long; antepenultimate palpal joint moderately enlarged; pile entirely pale; legs yellowish, apices of tibiae and all tarsi darkened; stem vein pale pilose.

Ovipositor: Long and stout but not reaching beyond middle of anal lobes. Lobes conical, equal or slightly exceeding the cerci, finely setose above, more coarsely so below but intergrading. Genital rod forked, each arm with a triangular chitinous expansion. (Figs. 3 and 4.)

Male hypopygium. Side pieces conical, stout, and strongly chitinized, longer than wide; chitin absent on one side (within), a small detached piece at base lying obliquely; bridge piece narrow, widening below and joining the basal prongs of the adminiculum. Clasper stout, conical, with three terminal claws. Adminiculum transverse, the center forming a projecting point, pilose, the angles strongly shouldered rounding over to the broad basal prongs. Membranous arms without hooks, granular. (Figs. 30 and 31.)

Type locality.—Moscow, Idaho.

Cotypes, two males, *allotype* female, Cat. No. 28329, U.S.N.M.

Three female specimens at hand, two males. The females are scarcely distinguished from *hirtipes;* the male structures very different.

Distribution.—COLORADO: Custer County (T. D. A. Cockerell) (no male).

IDAHO: Moscow Mountain June 1, 1907 (J. M. Aldrich). Moscow (J. M. Aldrich).

PROSIMULIUM PANCERASTES, new species

Near *exigens*. Differs in having the basal antennal joints yellow; the legs and the pile more deeply yellow.

Ovipositor: Essentially as in *exigens*. (Figs. 16 and 17.) The female specimen is from Lawyers Canyon, whereas the male type is

from Peck. It is not certain, therefore, that this is the true female of *pancērastes*.

Male hypopygium: Side piece conic, stout, about as wide as long, chitin absent within; bridge piece detached, forming a long bar triangularly widening outwardly and tipped by a horn; clasper narrow, angled, chitinized, the tip horn-like with three lumps on the margin. Basal prongs of adminiculum detached, forming a long curved bar on each side, its center produced, expanded outwardly and bifid (figs. 32 and 33).

Type locality.—Peck, Idaho.

Cotypes.—Two males, Cat. No. 28330, U.S.N.M.

The female is scarcely distinguishable from *hirtipes*. Sixty-nine specimens at hand.

Distribution.—ALASKA: Cape Fanshaw, June 22, 1919 (H. G. Dyar). Ketchikan, August 7, 1919 (H. G. Dyar). Seward, July 26, 1921 (J. M. Aldrich). Camp 327, Alaska Eng. Com., July 1, 1921 (J. M. Aldrich). Katmai, August, 1917 (J. S. Hine). Naknek Lake, July, 1919 (J. S. Hine). Logan, August 20, 1919 (J. S. Hine). Virgins Bay, June 26, 1899 (T. Kincaid). Kukak Bay, July 4, 1899 (T. Kincaid). Popoff Island, July 10, 1899 (T. Kincaid).

ARIZONA: Williams, June 3, 1901 (H. S. Barber).

BRITISH COLUMBIA: Prince Rupert, June 7, 1919 (H. G. Dyar). Laggan, August 16, 1906 (Dyar and Caudell). Kaslo, June 5, 1903 (H. G. Dyar).

CALIFORNIA: Gold Lake, July 20, 1916 (H. G. Dyar).

IDAHO: Peck, April 8, 1900 (J. M. Aldrich). Lawyers Canyon, June 16, 1909 (J. M. Aldrich). Sand Point, June 4, 1921 (H. G. Dyar).

MONTANA: Lake McDonald, June 22, 1921 (H. G. Dyar). Belton, June 18, 1921 (H. G. Dyar). Two Medicine River, July 27, 1921 (H. G. Dyar). Glacier Park, June 26, 1921 (H. G. Dyar).

WASHINGTON: Lake Cushman, July 5, 1920 (H. G. Dyar). Glacier, June 4, 1917 (H. G. Dyar).

WYOMING: Old Faithful, June 29, 1922 (H. G. Dyar).

YUKON TERRITORY: White Horse, June 1, 1916 (B. P. Clark). Dawson, September 8, 1912 (J. K. Jessup).

Genus EUSIMULIUM Roubaud

Eusimulium Roubaud, Comp. Rend. Acad. Sci. Paris, vol. 143, 1906, p. 519.
Prosimulium Malloch (part), U. S. Dept. Agric., Bur. Ent., Tech. Ser. No. 26, 1914, p. 14.
Prosimulium Enderlein (part), Deutsch. Tierarz. Woch., Hanover, 1920; Zool. Anz., vol. 53, 1921, p. 43.
Cnephia Enderlein, Deutsch. Tierarz. Woch., Hanover, 1920; Zool. Anz. vol. 53, 1921, p. 44.
Nevermannia Enderlein, Deutsch. Tierarz. Woch., Hanover, 1920; Zool. Anz. vol. 53, 1921, p. 44.

Genotype.—Simulium aureum Fries. This species must be taken as the genotype since it was the only species mentioned under *Eusimulium* when Roubaud established the genus.

Eusimulium differs from *Prosimulium* chiefly by having the radial sector simple (i. e. R_{2+3} is absent). The pilosity of the entire length of the radial vein distinguishes it from Simulium. In other respects it is intermediate between *Prosimulium* and *Simulium*. The fore tibia is usually without silvery pollinosity and the fore tarsi are usually slender and cylindrical (*aureum* has the fore tibia somewhat silvery pilose and the fore tarsi somewhat broader). The hind basitarsus has the apical projection and the hind second tarsus has a more or less well defined dorsal incision in certain species. The abdomen is opaque, rarely subshining, the chitinous plates two to six are reduced in width and the abdominal venter is almost entirely membranous.

TABLE OF SPECIES OF EUSIMULIUM ROUBAUD

(Based on female hypopygia. *Obtusum* and *pugetense*, founded on males, omitted)

Ovipositor flaps very large, extending to tips of anal lobes—frisoni, new species.
Ovipositor flaps small.
Anal lobes of the female greatly reduced, the ventral areas bearing short setae.
Anal lobes chitinized and curved—aureum (Fries).
Anal lobes not more chitinized than cerci.
Ventral portion of anal lobe broad, curved, and with dense spicules along the margin—mexicanum (Bellardi).
Ventral portion narrowly produced and with fine setae.
callidum, new species.
Ventral lobe rounded with few short tubercular setae.
Lateral plates of genital rod without chitinized ridge.
mutatum (Malloch).
These plates with median chitinized ridge—permutatum, new race.
Anal lobes of female moderate not modified into special shape.
Lateral arms of the genital rod each with central tooth.
This tooth small and irregular, the arms widely divaricate.
This tooth single—dacotense, new species.
This tooth double or irregular—{pecuarum (Riley). / congareenarum, new species.

This tooth larger, the arm half or more encircling genital opening.

Tooth moderate { minus, new species. / clarum, new species.

Tooth large.

Mesopleural membrane with tuft of pile ..... boreale (Malloch).

Mesopleural membrane bare ..... canonicolum, new species.

Tooth very large, forming a lateral arm ..... johannseni (Hart).

Lateral arms of genital rod without tooth, widely and quadrately expanded. alticolum, new species.

TABLE OF SPECIES OF EUSIMULIUM ROUBAUD

(Based on external characters)

Claws simple.

Hind tibial spurs unusually long; hind basitarsus with a prominent projection; hind second joint with a slight dorsal incision.

Eastern North America ..... mutatum (Malloch).

Western North America ..... permutatum, new race.

Hind tibial spurs moderate; hind basitarsus with very slight projection; the following joint without dorsal incision ..... frisoni, new species.

Claws with basal tooth; hind tibial spurs normal; hind second tarsus with dorsal incision, except *pecuarum*.

Postnotum with brassy scales; mesonotal pile brassy, scalelike. aureum (Fries).

Postnotum without brassy scales; mesonotal pile not brassy, except *mexicanum*.

Thoracic integument yellow with silvery pollinose stripes.

Without brownish stripes ..... ochraceum (Walker).

With brownish stripes in addition ..... callidum, new species.

Thoracic integument not yellow.

Mesopleural membrane with tuft of pile ..... boreale (Malloch).

Mesopleural membrane bare.

Antenna elongate, distinctly larger than fore basitarsus; integument brownish ..... alticolum, new species.

Antenna normal, smaller than fore basitarsus.

Stem vein pale pilose.

Bluish-gray species with yellowish legs. congareenarum, new species.

Blackish species with blackish legs.

Abdominal tergites of general dark gray color (eastern United States) ..... johannseni (Hart)

Abdominal tergites 3, 4, 5, and 6 reduced to small plates, bluish (drier regions of western United States). clarum, new species.

Stem vein dark pilose.

Hind basitarsus truncate apically, the ventral line with a small apical spur.

Stem vein dark pilose (South Dakota) .. dacotense, new species.

Stem vein pale pilose (southeastern part of United States). pecuarum (Riley).

Hind basitarsus with apical projection on inner surface.

Tergites 2, 3, 4, and 5 not greatly reduced; legs black. minus, new species.

Tergites 2, 3, 4, and 5 greatly reduced; legs bicolored. mexicanum (Bellardi).

The following are omitted from this table: *Eusimulium obtusum*, *pugetense*, and *canonicolum*.

EUSIMULIUM AUREUM (Fries)

Simulia aureus FRIES, Monogr. Simul. Suec., 1824, p. 16.

The bright, brassy, scale-like body pile and the patch of brassy scales on the postnotum characterize both sexes of this species. The legs including the fore coxae are largely light yellow; the fore tarsi of the female are broadened, the fore tibia has silvery pile; the hind basitarsus has the apical projection; the second hind tarsus has the dorsal incision and the claws are provided with a dorsal tooth.

Female hypopygium. Cerci large, quadrate, transverse, setose. 9th sternites chitinized, curved, rather small, rounded, sparsely setose on the margin only. Ovipositor flaps conical, remote at tips, weakly membranous, spicular. Genital rod widely forked, each arm expanded into a plate carrying a large blunt tooth. (Fig. 44.)

No male is before us, unless the species hereinafter described as *Eusimulium obtusum* is the missing male of the form we here identify as *aureum* Fries.

Eusimulium aureum occurs commonly in Europe where it was originally described, and is recorded from North Africa. It is not known to be a blood-sucker and is rather rarely collected in North America.

Type locality.—Unknown to us, as is the present location of type.

Distribution.—ALASKA: Katmai, August, 1917 (J. S. Hine). Savonoski, Nanek Lake, June, 1919 (J. S. Hine).
CALIFORNIA: Los Angeles County (D. W. Coquillett). Palo Alto, April 11 (J. M. Aldrich).
COLORADO: Boulder (T. D. A. Cockerell).

EUSIMULIUM AUREUM BRACTEATUM (Coquillett)

Simulium bracteatum COQUILLETT, U. S. Dept. Agr. Bur. Ent., Bull. 10, n. s., p. 69, 1899.

Simulium bracteatum MALLOCH, U. S. Dept. Agr. Bur. Ent., Tech. Ser. No. 26, 1914, p. 38.

Superficially similar to *aureum;* in the female hypopygium the ovipositor flaps are smaller, the ninth tergites less rounded and with a ventral point.

Male hpyopygium: Side piece large, conic, quadrate, a chitinized bridge and reëntrant arm on one side. Clasper small, angled, with stout terminal tooth. Adminiculum small, conic-pointed, hirsute, the basal prongs triangularly widening, divaricate. Adminiculum arms with a convex membrane and two large teeth, divaricate from its base. (Figs. 24, 25, and 26.)

Type locality.—Cambridge, Mass. Type in U. S. National Museum, Cat. No. 10380, U.S.N.M.

Distribution.—ILLINOIS: Elizabeth, July 7, 1917.
KANSAS: (J. M. Aldrich).
MARYLAND: Plummers Island, April 19, 1903 (H. S. Barber).
MASSACHUSETTS: Cambridge, May 31, 1869 (H. A. Hagen?).
MICHIGAN: Battle Creek (J. M. Aldrich).
NEW HAMPSHIRE: Franconia (A. T. Slosson).
SOUTH CAROLINA: Spartanburg, July 25, 1913 (A. W. Jobbins-Promeroy).

EUSIMULIUM OBTUSUM, new species

An allied species is before us, male examples only, which we have consequently been unable to place in the table.

Male hypopygium: Side piece stout conic, large chitinous ridge half the side piece, reëntrant portion oblique, lateral, clasper small and stout, but broad, with square tips, a tooth on each angle. Adminiculum with divaricate triangular basal arms, but itself broadly concave, hirsute. Adminiculum arms with two long divaricate teeth from the base of a convex strigose membrane. (Figs. 27, 28, and 29.)

Type locality.—Redlands, Calif.

Cotypes.—Two males, Cat. No. 28331, U.S.N.M.

Distribution.—CALIFORNIA: Redlands, 1914 (F. R. Cole).

This may be the male of the species we here identify with *Eusimulium aureum* (Fries) of Europe. If this be the case, *aureum* and *bracteatum* must be considered as distinct species instead of races as we here place them. We are unsupplied with sufficient material of the European form to decide whether *aureum* is the same as our western form as we here assume, or as the eastern one (*bracteatum*), or whether it is distinct from both. We retain the name *obtusum* to cover these eventualities.

EUSIMULIUM MEXICANUM (Bellardi)

Simulium mexicanum BELLARDI, Ditterlogia Messicana, Append. 6, 1861, p. 3.

A large species, showing strong relationships with *Simulium* proper. The subshining frons, yellowish basal antennal joints, yellow coxae, bicolored legs; abdominal tergites reduced to small opaque plates, the terminal tergites shining, well developed apical projection on hind basitarsus and well marked dorsal incision of hind second tarsus which characterize this species are also found in typical species of *Simulium*. In addition it should be noted that the tho-

racic pile is very short, scattered and brassy. The radius is completely pilose on the upper surface.

Cerci, broadly conical, setose. Anal lobes narrow below the cerci, broadly expanded ventrally, the ventral edge thickened and with many rows of fine hooks, the upper part of the sclerite coarsely setose. Ovipositor flaps remote at tip, large and coarse, conical, finely pilose. Forks of genital rod broadly expanded, one side a hornlike prominence. (Fig. 46.)

Two females.

Type locality.—Mexico. The present location of the type is unknown to us.

Distribution.—Mexico: Cordoba, January 30, 1908 (F. Knab).

EUSIMULIUM OCHRACEUM (Walker)

Simulium ochraceum Walker, Trans. Ent. Soc. Lond., n. ser., vol. 5, 1860, p. 332.

Front and face subperlaceous; first two antennal joints yellow, remainder black; disk of mesonotum orange, the humeri and lateral margins and scutellum bright yellow, the second paratergite (Crampton) black. A pair of silvery pollinose stripes on mesonotum. Legs entirely blackish. Basal scale present on second tarsal joint; apical projection of hind basitarsus very prominent. Claws with a subbasal tooth. Four basal abdomnal segments yellow, the fifth opaque black, remainder shininng black. Radius entirely setose. Halteres bright yellow.

Type locality.—Mexico. The type is lost.

Distribution.—Mexico: Tuxtla Gutiérrez, Chiapas (A. L. Herrera). Simejevel, Chiapas (A. L. Herrera).

EUSIMULIUM CALLIDUM, new species

Simulium ochraceum Malloch (not Walker), U. S. Dept. Agr., Bur. Ent., tech. ser. No. 26, 1914, p. 30.

A species of dominant yellowish color. A pair of median silvery pollinose stripes and a pair of sublateral brown stripes; legs largely yellow, including fore coxae; apical projection of hind basitarsus and dorsal incision of second hind tarsus well developed.

Cerci rounded quadrate, dark brown, darker than any other parts. Anal lobes somewhat narrowed below the cerci, forming a little hairy lobe between them, produced ventrally and reaching to a rounded posterior point, which is densely covered with fine short setae. Ovipositor valves conic, remote at tip, weak, the slight forks of genital rod widely expanded and angled on both sides. (Fig. 41.)

Type locality.—Cordoba, Mexico.

Type.—Female, *allotype*, female, Cat. No. 28677, U.S.N.M.

Distribution.—Mexico: Cordoba, March 16, 1908 (F. Knab).

EUSIMULIUM MUTATUM (Malloch)

Prosimulium mutatum MALLOCH, U. S. Dept. Agr., Bur. Ent., tech. ser. No. 26, 1914, p. 20.

The dark color of body and legs, the simple claws, the prominent apical projection of the hind basal tarsus, the absence of a dorsal incision on the following joint and the unusually long spurs of the hind tibiae easily identify this species.

Ovipositor: Cerci rounded quadrate, setose. Anal lobes narrow behind cerci, with a distinct setose lobe below cerci, expanded roundedly and transparent below with about 5 short spines from tubercles. Forks of genital rod quadrately expanded with short irregular teeth, evenly pale chitinized. (Figs. 34 and 35.)

One hundred and ten specimens at hand.

Type locality.—Glassboro, N. J. The type is in the U. S. National Museum, Cat. No. 15404, U.S.N.M.

Distribution.—ILLINOIS: Meredosia, May 28, 1917 (———).
INDIANA: La Fayette, May 4 (J. M. Aldrich).
MARYLAND: Plummers Island, April 16, 1915 (R. C. Shannon).
MISSOURI: St. Louis, April 6, 1904 (W. V. Warner).
NEW JERSEY: Glassboro, March 28, 1910 (C. T. Greene). Riverton, May 5, 1924 (H. C. Hallock). Pemberton, April 22, 1914 (H. B. Scammell). Iona, April 20, 1903 (———). Jamesburg, April 30, 1911 (———). Paterson, May 3 (———).
VIRGINIA: Dead Run, Fairfax County, April 11, 1914, April 23, 1915 (R. C. Shannon).

EUSIMULIUM MUTATUM PERMUTATUM, new race

Similar to *mutatum* Malloch, but in the female the forks of the genital rod have a row of ragged teeth outwardly, and the end of the plate is darkly chitinized. (Fig. 36.)

Type locality.—Prince Rupert, British Columbia.

Type.—Female, *paratypes* 5 females, Cat. No. 28332, U.S.N.M. 89 specimens before us, all females.

Distribution.—ALASKA: Camp 327, Alaska Eng. Comm. July 13, 1919 (J. M. Aldrich), Katmai, July, 1917 (J. S. Hine). Cape Fanshaw, June 22, 1919 (H. G. Dyar). Ketchikan, June 8, 1919 (H. G. Dyar). Sitka, June 16, 1899 (T. Kincaid). Virgins Bay, June 26, 1899 (T. Kincaid). Yakutat, June 21, 1899 (T. Kincaid).

BRITISH COLUMBIA: Kaslo, April 8, 1903 (R. P. Currie). Prince Rupert, June 17, 1919 (H. G. Dyar).

CALIFORNIA: Gold Lake, Plumas County, July 19, 1916 (H. G. Dyar). Tahoe City, June 29, 1920 (H. G. Dyar).

IDAHO: Moscow Mountain, June 1, 1907 (J. M. Aldrich).

MONTANA: Missoula, July 6, 1917 (H. G. Dyar). Glacier Park, June 26–July 1, 1921 (H. G. Dyar). Belton, June 2, 1921 (H. G. Dyar). Two Medicine River, July 27, 1921 (H. G. Dyar).

WASHINGTON: Bremerton, April 29, 1924 (H. G. Dyar). Ashford, June 9, 1921 (H. G. Dyar). Hoodsport, May 3, 1924 (H. G. Dyar). Glacier, June 4, 1917 (H. G. Dyar).

WYOMING: Yellowstone Canyon, July 6, 1922 (H. G. Dyar).

EUSIMULIUM FRISONI, new species

A very distinct species characterized by simple claws; hind tibial spurs moderate; hind basitarsus with a very slight projection; the following joint rather long, nearly six times as long as broad, without a dorsal incision. In other respects similar to *mutatum* Malloch. Hypopygium: Cerci, anal lobes, and ovipositor flaps usually large. (Plate 1, fig. E).

Type locality.—Alto Pass, Ill.

Type.—Female, Cat. No. 28725, U.S.N.M.

Distribution.—Illinois, Alto Pass, May 8, 1917 (———).

Named for Theodore Frison, who has assisted our work very materially by placing at our disposal the important collection of Simuliidae of the Illinois Natural History Laboratory.

EUSIMULIUM PECUARUM (Riley)

(?) *Simulium invenustum* WALKER, List Dipt. Brit. Mus., vol. 1, 1848, p. 112.

Simulium pecuarum RILEY, Rept. Dept. Agr. 1886, p. 512.

Prosimulium pecuarum MALLOCH, U. S. Dept. Agr. Bur. Ent., tech. ser. No. 26, 1914, p. 21.

Female.—Entirely blackish; front at narrowest width scarcely more than the width of antenna, with loose pale pile; two basal joints of antenna yellowish brown, mesonotum with three faint longitudinal vittae; legs brownish; fore tarsi slender, cylindrical; claws with a basal tooth; hind basitarsus with slight projection; hind

second tarsus without dorsal incision; abdominal dorsal plates broader than long.

Hypopygium: Cerci rounded quadrate, transverse. Ninth sternite triangular normal, more heavily chitinized on its posterior border, setae absent on lower border. Ovipositor valves slight, thin. Forks of genital rod widely divaricate, expanded, each with a large irregular double or triple tooth. (Fig. 37.)

E. pecuarum has been recorded from Westville, Conn., and Iona, N. J. Specimens from the former locality are not at hand and the specimen from Iona proves to be *mutatum*. Another specimen from New Hampshire placed with *pecuarum* in the collection proves to be *P. hirtipes*. It has also been reported from Illinois. This may be *invenustum* Walker, but we have no positive information. One hundred and ninety specimens at hand.

Type localities.—Of *invenustum*.—Martins Fall, Ontario. The type is in the British Museum. The junior author examined it in August, 1925, and found it to have the characters of *pecuarum* or *dacotense*. A third species may possibly be represented, so we refrain from a positive reference.

Of *pecuarum*.—Somerset Landing, La. The type is in the U. S. National Museum, Cat. No. 772, U.S.N.M.

Distribution.—ARKANSAS: Manila (M. M. Hinesly).

LOUISIANA: Somerset Landing, April 10, 1886 (F. M. Webster). Mansura, February 24, 1910 (C. E. Wood).

MISSISSIPPI: Lake Horn, March 16–May 6, 1886 (F. M. Webster). Lake View, April 10–May 4, 1886 (F. M. Webster).

TEXAS: College Station (F. M. Webster).

Eusimulium pecuarum (Riley) for a long series of years during and following the Civil War was an unusually serious menace to livestock and even to human beings along the lower Mississippi. Great numbers of cattle and mules perished as a result of their attacks. No serious outbreaks have occurred during the past 30 to 40 years.

The late Francis M. Webster accounted for this thus: The reason for these particularly severe outbreaks and their absence in recent years is accounted for by the fact that prior to the Civil War the levees of the Mississippi were in good condition and continuous through all of the alluvial country of the lower Mississippi; but with the outbreak of the war the levees were neglected and in many cases caved in. The adjoining lands became flooded, making ideal breeding conditions for the black flies. During the war the plagues of Buffalo gnats became so great and so severe that the Cavalry

and Artillery horses of both armies were killed in numbers and in some instances every horse and mule was killed on some plantations. The gnats do not breed in the deep waters of the Mississippi itself, and as no overflows occur now there are no longer extensive breeding places, hence we have an absence of the *Simuliums*.

EUSIMULIUM CONGAREENARUM, new species

Simulium meridionale MALLOCH (part), U. S. Dept. Agr., Bur. Ent., tech. ser. No. 26, 1914, p. 50.

Female.—Thorax and head bluish gray with pale, sparse, closely appressed and somewhat scale-like pile; front moderately narrowed; antennae small, shorter than fore basitarsus, the two basal joints brownish, remainder black; legs, including fore coxae yellowish brown, apices of tibiae and tarsi darker; second hind tarsus with moderate dorsal incision; basal tooth of claws rather small; fore tarsi slender, the third and fourth joints a little flattened; dorsal plates of abdomen broad, blackish, becoming bluish gray posteriorly; sides of second tergite with large bluish gray pollinose patches clothed with short white pile. Hypopygium as in *pecuarum*. (Fig. 45.) Wing veins brownish, more yellowish basally; stem vein white pilose; length about 3 mm.; wing 2.75 mm.

This species is apparently nearest to *aureum*. The brassy scale-like pile on the thorax and postnotum of *aureum* serve to separate them.

Twenty-four specimens.

Type locality.—Congaree, S. C.

Type.—female, *paratypes* 23 females, Cat. No. 28333, U.S.N.M.

Distribution.—SOUTH CAROLINA: Congaree, March 17 and April 22, 1912 (Jennings and King).

EUSIMULIUM DACOTENSE, new species

The pile on the stem vein is dark as in *pecuarum*.

Female hypopygium: The tooth on the arm of the genital fork is single and slighter, while the arms are less expanded or more plate-like than in *pecuarum* with which it is otherwise identical. (Fig. 48.)

Male hypopygium: Side piece short conic with bridge and reëntrant piece. Clasper slender, conical, pointed at tip, with a small tooth, almost as long as side-piece but much narrower. Adminiculum very broad, full, convex, hirsute except toward the wings, the basal prongs short, pointed and directed straight basally. Adminiculum arm forming a long folded ridge with two or three large stout teeth at the prominence of the ridge on each side. Lateral chitinous plate large, conical. (Figs. 49, 50, and 51.)

Type locality.—Brookings, S. Dak.

Types.—Two males, *paratypes* three females, Cat. No. 28334, U.S.N.M.

Distribution.—SOUTH DAKOTA: Brookings (J. M. Aldrich).

EUSIMULIUM MINUS, new species

This differs from *pecuarum* by its smaller size and darker color, projection on the hind basitarsus and dorsal incision on second hind tarsus.

Female hypopygium: Cerci and anal lobes normal. Genital rod forks triangularly expanded, each with a large single tooth. (Fig. 39.) Ovipositor flaps slight.

Type locality.—Yosemite, Calif.

Type.—Female, *paratypes* 27 females, Cat. No. 28335, U.S.N.M. Fifty-nine specimens, all females, at hand.

Distribution.—ALASKA: Fairbanks, June 29, 1921 (J. M. Aldrich). Katmai, July–August, 1917 (J. S. Hine).
CALIFORNIA: Yosemite, May 15–17, 1916 (H. G. Dyar). Fallen Leaf, Lake Tahoe, June 5–10 1916 (H. G. Dyar). Clio, July 9, 1916 (H. G. Dyar).
IDAHO: Moscow (J. M. Aldrich).
MONTANA: Belton, June 19, 1921 (H. G. Dyar).
WASHINGTON: Glacier, June 4, 1917 (H. G. Dyar). Ashford, June 19, 1921 (H. G. Dyar). Olga, July 14 (J. M. Aldrich).
WYOMING: Old Faithful, Yellowstone Park, June 27, 1922 (H. G. Dyar).

EUSIMULIUM CLARUM, new species

Simulium meridionale MALLOCH (part), U. S. Dept. Agr., Bur. Ent., tech. ser., No. 26, 1914, p. 50.

Female.—Resembles *johannseni*, but differs in having smaller dorsal plates on abdomen, which are bluish gray; the pile on abdomen is sparser and tends to be more scale-like; stem vein pale pilose. Otherwise as in *minus*.

Female hypopygium as in *minus*. (Fig. 38.)

Male hypopygium. Side piece conical, longer than wide, with bridge and short reentrant piece. Clasper thick, the tip drawn out at one angle, with a small inserted tooth. Adminiculum broad, arcuate, hirsute, the dorsal prongs short, pointed, directed straight basally. Adminiculum arms a long folded ridge, the inner conjoined area as long as side piece, double, brown, the outer ridge with many large teeth in a row; side plates small, chitinized, fimbriate. (Figs. 52 and 53.)

Fifteen specimens.

Type locality.—Fresno, Calif.

Types.—Three males, *paratypes* four females, Cat. No. 28336, U.S.N.M.

Distribution.—CALIFORNIA: Fresno, March 15–May 13, 1900 (E. A. Schwarz), March 17–May 12, 1923 (M. E. Phillips).

MONTANA: Glacier Park, June 28, 1921 (H. G. Dyar).

NEVADA: Fallen, May 28 (F. C. Bishopp). Pyramid Lake, July (J. M. Aldrich).

EUSIMULIUM BOREALE (Malloch)

Prosimulium borealis MALLOCH, Rept. Can. Arctic Exp., 1913–18, vol. 3, 1918, p. 418.

A species easily characterized by the presence of a tuft of pile on the membranous part of the mesopleura (the anepisternal cleft of Crampton). Body grayish black with dense pale pile unusually long on the scutellum; fore tarsi very slightly broadened; hind basitarsus with slight projection; hind second tarsus without dorsal incision; claws with basal tooth; wing veins with dark brown pilosity. Female hypopygium similar to *minus* and *clarum*, but each arm of the genital rod bears a very large blunt tooth, the plates are wider and slightly more nearly surround the genital orifice. (Fig. 43.)

Type locality.—Woolaston Peninsula, Victoria Island. Type in the Canadian National Collection.

Three females at hand.

Distribution.—MONTANA: Two Medicine River, July 27, 1921 (H. G. Dyar).

EUSIMULIUM CANONICOLUM, new species

As in *boreale*, smaller; membrane of mesopleura without tuft of pile. Female hypopygium as in *boreale*. (Fig. 43.)

Type locality.—Yellowstone Canyon, Wyo.

Type.—Female, *paratypes* two females, Cat. No. 28337, U.S.N.M.

Distribution.—CALIFORNIA: Summit, Placer County, July 19, 1915 (H. G. Dyar). Fallen Leaf Lake, June 4, 1916 (H. G. Dyar).

COLORADO: Grand Lake, June 19, 1923 (H. G. Dyar).

IDAHO: Albion (J. M. Aldrich).

WYOMING: Yellowstone Canyon, July 1–6, 1922 (H. G. Dyar). Mammoth Hot Springs, July 14, 1922 (H. G. Dyar).

EUSIMULIUM JOHANNSENI (Hart)

Simulium johannseni HART, 27th Rept. St. Ent. Ill., 1912, p. 32.
Simulium meridionale MALLOCH (part), U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 49.

Differs from *pecuarum* in having the stem vein white pilose; the abdomen more profusely pilose; the hind basitarsus with a slight dorsal incision. Female hypopygium: Cerci rounded quadrate, setose; anal lobes moderate, unmodified, similar to cerci. (Fig. 19.) Ovipositor valves slight, membranous. Genital rod with the forks largely surrounding the orifice each with a long oval arm in place of a tooth. (Fig. 42.)

Male.—Side piece conical quadrate, as broad as long, ridge nearly central, reëntrant angle of margin long. Clasper stout, smooth, tip obliquely truncate with rudimentary but large tooth on the angle, not so long as side piece, nearly half as thick. Adminiculum arcuate, somewhat truncate-tipped, hirsute, the basal prongs large, curved, thick, forming an arc wider than the adminiculum. Adminiculum arms with a small group of very long teeth at each outer fold, the conjoined portion inconspicuous. Lateral plates large, grooved on the margin. (Figs. 54 and 55.)

Twenty specimens at hand.

Type locality.—Havana, Ill. Type in the Illinois State Natural History Laboratory.

Distribution.—IDAHO: Kendrick, May 25, 1902 (J. M. Aldrich).
ILLINOIS: Havana, April 26–May 1, 1912 (C. A. Hart). White Heath, April 26, 1916 (———).
MASSACHUSETTS: Hyde Park, May 4, 1914 (———).
MONTANA: Great Falls, July 7, 1921 (H. G. Dyar).
ONTARIO: Waubamic, Parry Sound, June 8, 1915 (J. M. Aldrich).

EUSIMULIUM PUGETENSE, new species

Male hypopygium: Side pieces conic-quadrate, as broad as long, bridge broad, formed by basal and apical emargination of the chitin; basal reëntrant angle short but distinct. Clasper long, rather stout, uniform, the tip roundedly angled, with short obsolete but stout tooth. Adminiculum broad, arched, the center depressed, with a rounded hirsute nipple, the rest of the adminiculum smooth and platelike; basal prongs stout, tapered, incurved, much darker than the disk. Adminiculum arms with a single very long stout tooth in each fold. (Figs. 121, 122, and 123.)

Type locality.—Seattle, Wash.

Type.—Male, Cat. No. 28338, U.S.N.M.

Distribution.—WASHINGTON: Seattle (C. V. Piper).

EUSIMULIUM ALTICOLUM, new species

Female.—Entirely reddish brown; antennae large, noticeably larger than fore basitarsus; front narrow; fore tarsi slender; hind basitarsus with a prominent projection, the following joint without dorsal incision; claws with large basal tooth; pilosity of wing veins entirely reddish brown, abdominal tergites but little reduced.

Length 3 mm.; wing 3.25 mm.

Ovipositor valves short and weak; a chitinous arm before them. Cerci conical quadrate, darker than other parts; 9th sternite triangulate, unmodified; arm of genital rod three-fourths surrounding opening, roundedly angled, with quadrate terminal plates and no tooth. (Fig. 47.)

Type locality.—Sierra Madre, Mexico.

Type.—Female, Cat. No. 28339, U.S.N.M.

Distribution.—MEXICO: Headwaters of Rio Piedras Verdes, altitude 7,300 feet, Sierra Madre, Chihuahua, May 9 (or September 5?) (C. H. T. Townsend).

Genus SIMULIUM Latreille

Melusina MEIGEN. Nouvelle Classification, 1800 (nomen nudum).
Simulium LATREILLE, Hist. Nat. Ins. et Crust., vol. 3, 1802, p. 426.
Atractocera MEIGEN, Klass., vol. 1, 1804, p. 94.

Perhaps most of the generic names proposed by Enderlein under the subfamily Simuliinae are synonyms of the genus *Simulium* as it is here understood.

Genotype.—(*Culex colombaschensis* Fabricius)=*Culex reptans* Linnaeus.

Description of the genus: The radius is bare along the section between the stem vein and the forking of the radius; the radial sector is simple; the hind basitarsus has an apical projection and the second hind tarsus has a dorsal incision. The front is usually broad; the fore tibia with or without a white pollinose patch; the fore tarsi are slender or broadened; the dorsal plates of the abdomen are usually much reduced and the claws may be toothed or simple.

KEY TO THE SPECIES OF SIMULIUM, BASED ON MALE HYPOPYGIA

Adminiculum broad, membranous.
  Adminiculum divided_____ **pictipes Hagen.**
  Adminiculum entire.
    Clasper angled, with pilose projection at angle____ **hydationis, new species.**
    Clasper not angled.
      Clasper broad at tip with 3 or 4 teeth.
        Adminiculum arms with slight dentation_____ **vittatum Zetterstedt.**
        These arms with strong dentation_____ **decorum Walker.**

Clasper simple or with a single spine at tip.
Adminiculum simple, arcuate.
Adminiculum arms with 3 very large teeth on each side.
occidentale Townsend.
These arms with smaller, more abundant dentation.
No projection at base of clasper.
Teeth of adminiculum arms approximate— notatum Adams. venator, new species. griseum Coquillett. trivittatum Malloch.
Three small teeth separated by fimbriae— piperi, new species.
A round projection at base of clasper— slossonae, new species.
Adminiculum with central cone, traversing and exceeding disk.
virgatum Coquillett.
Adminiculum contracted, solid, tooth-shaped.
Clasper with a spinose projection at base.
Projection rounded— perissum, new species.
Projection narrow and compressed.
Adminiculum broad, quadrate— vandalicum, new species.
Adminiculum conical, narrow— jacumbae, new species.
Clasper simple.
Adminiculum with a central lacuna and narrow tip— parnassum Malloch.
Adminiculum tooth-shaped.
Spines of adminiculum and adminiculum arms large— arcticum Malloch.
Spines of adminiculum and adminiculum arms small— venustum Say.

No males are at hand of *meridionale, hunteri, sayi, haematopotum, trivittatum, mediovittatum, bivittatum,* and *metallicum.*

KEY TO THE SPECIES OF SIMULIUM, BASED ON FEMALE HYPOPYGIA

Anal lobe broad and setose laterally.
Anal lobe not strongly produced ventrally.
Anal lobe rounded, unmodified, similar to the cerci.
Anal lobe not widened ventrally, uniform.
Forks of genital rod with large triangular widenings.
slossonae, new species
Forks of genital rod with small triangular widenings.
meridionale Riley.
Forks of genital rod with distinct tooth.
The chitinized rod beyond tooth straight and smooth.
occidentale Townsend.
The part of arm beyond tooth irregularly margined.
Tooth sharp and slender— perissum, new species.
Tooth blunt, truncate— venustum Say. arcticum Malloch.
Anal lobe roundedly widened ventrally, the part behind cerci narrow.
Anal lobe with large clear expanded area with many fine setae.
vitattum Zetterstedt.
Anal lobe with small ventral pilose area or none.
Tips of ovipositor sheaths approximate, dark brown, fimbriage.
Arms of genital rod with large dark tooth expanded beyond into membrane— decorum Walker.
These with moderate nontruncate tooth— parnassum Malloch.

Anal lobe heavily chitinized and modified.
Anal lobe broad below ..... pictipes Hagen.
Anal lobe curved posteriorly, narrowly truncate.
Anal lobe more slender than cerci.
Arms of genital rod with short round teeth ..... hunteri Malloch.
These with long sharp tooth ..... sayi, new species.
Anal lobe produced, as long as cerci ..... metallicum Bellardi.
Anal lobe sharply produced ventrally.
Anal lobe ventrally with a clear angle.
Arms of genital rod quadrate, half surrounding genital opening, expanded with chitinized rod to tip with long tooth from its base. haematopotum Malloch.
Arms narrow, widely expanded, extending beyond the chitinized rod, with a curved apical chitinization but no tooth ..... mediovittatum Knab.
Anal lobe ventrally drawn out into a long digitate process.
Anal lobe triangularly produced, not chitinized anteriorly, or weakly chitinized ..... bivittatum Malloch. notatum Adams. griseum Coquillett.
Anal lobe digitately produced, more distinctly chitinized anteriorirly ..... trivittatum Malloch. venator, new species.
Anal lobe narrow with a single row of very coarse setae, expanded below; arms of genital rod with chitinized horns at inner and outer angles and at tip; ovipositor flaps thin but long ..... virgatum Coquillett.

We have no females of *hydationis*, *piperi*, *vandalicum*, and *jacumbae*.

KEY TO FEMALES OF SIMULIUM, ACCORDING TO EXTERNAL CHARACTERS

Claws with a very strong basal projection, without subbasal tooth.
Front narrow, grayish opaque; fore coxae and legs normal, entirely black; mesonotum trivittate; grayish species. meridionale Riley; occidentale Townsend.
Front broad and shining black; fore coxae yellowish; legs bicolored; mesonotum very indistinctly bivittate; shining black species. slossonae, new species.
Claws with the base but little produced, but with a subbasal tooth; legs bicolored
Frons opaque, grayish pruinose.
Fore coxae yellowish; eyes very deeply incised ..... virgatum Coquillett.
Fore coxae blackish; eyes moderately incised ..... sayi, new species.
Frons shining black; fore coxae yellowish.
Mesonotum distinctly trivittate.
Mesonotum without pearlaceous coloring ..... hunteri Malloch.
Mesonotum with distinct pearlaceous coloring ..... metallicum Bellardi.
Mesonotum without vittae.
Mesonotal and stem vein black pilose ..... parnassum Malloch.
Mesonotal and stem vein pale pilose ..... arcticum Malloch.
Claws simple, legs bicolored.
Fore coxae black; frons opaque, grayish pollinose; last 3 tergites subopaque, dusted with gray pollinosity.
Fore tibia partly yellow with a large white pollinose patch; 5 mesonotal stripes ..... vittatum Zetterstedt.
Fore tibia entirely grayish black, without white pollinostity, although white pile is present; 3 mesonotal stripes ..... pictipes Hagen.

Fore coxae yellow.
Tergites large, the fifth large and subshining like the following; frons subopaque; mesonotum with a pair of indistinct vittae___ decorum Walker.
Tergites 2, 3, 4, 5, and 6 greatly reduced, the 6th yellowish with a central black spot. Frons opaque or pearlaceous.
Mesonotum with 7 distinct stripes.
With 3 dark stripes.
The pale stripes pearlaceous; frons pearlaceous. haematopotum Malloch.
The pale stripes silvery white; frons gray___ trivittatum Malloch.
With 3 orange-colored stripes_____ bivittatum Malloch.
Mesonotum with a single stripe or none; frons grayish.
Mesonotum with a distinct median stripe.
Second tergite without central black spot_____ venator, new species.
Second tergite with a black spot_____ mediovittatum Knab.
Mesonotum with an indistinct stripe or none.
Mesonotum strongly arched_____ notatum Adams.
Mesonotum moderately arched_____ griseum Coquillett.
Tergites 3, 4, and 5 greatly reduced, opaque velvet black; remaining shining_____ { perissum, new species. / venustum Say.

The following are not placed in this table: *hydationis*, *piperi*, *vandalicum*, and *jacumbae*.

SIMULIUM PICTIPES Hagen

Simulium pictipes HAGEN, Proc. Bos. Soc. Nat. Hist., vol. 20, 1879, p. 305.
Simulium innoxium COMSTOCK, Manual for the Study of Insects, 1895, p. 452.

A close ally of *Simulium vittatum*. Differs in having three mesonotal vittae; fore tibia entirely blackish and without the pollinose area, although the pile is whitish, and the black markings of the abdomen undivided.

Female hypopygium: Cerci rounded quadrate, infuscated, setose. Anal lobe conically produced ventrally, chitinized, especially on anterior edge, finely pilose behind. Ovipositor flaps thin, membranous, rather remote, narrow; arms of genital rod widely triangular, widened outwardly, chitinized there, with a small tooth before the widening. (Figs. 60 and 61.)

Male hypopygium: Side-piece quadrate, outer apical angle produced. Clasper long, rounded, contracted centrally, without terminal spine. Adminiculum broad, membranous, pilose, cleft mesially nearly to its base. Adminiculum arms with a group of rather large but few teeth in the bends; lateral plate large. (Figs. 100, 101, and 102.)

Type localities.—Of *pictipes*, Au Sable River, N. Y. Type in the Museum of Comparative Zoology, Cambridge, Mass.

Of *innoxium*, Ithaca, N. Y., type presumably in the Cornell University collection.

Our records of *pictipes* are confined to the Eastern United States. Fifty-two specimens.

Distribution.—DISTRICT OF COLUMBIA: Piney Branch, April 1, 1906 (D. H. Clemons).

MARYLAND: Plummers Island, April 22–August 28, 1902–05 (Schwarz and Barber).

MINNESOTA: St. Paul, July 22–August 15, 1901 (O. A. Johannsen).

NEW YORK: Ithaca, September 2, 1888 (L. O. Howard).

VIRGINIA: Rosslyn, July 7–October 5, 1912 (J. R. Malloch); September 22, 1911 (Knab and Malloch). Great Falls, May 30, 1914 (A. W. Jobbins-Pomeroy).

SIMULIUM HYDATIONIS, new species

Male hypopygium: Side-piece very short conical, twice as wide as long, clasper rather long, stout, elbowed at basal third, the expansion finely pilose; tip of clasper rounded, without spine. Adminiculum broad, membranous, transverse, arched, pilose, the stili short, stout, directed basally. Arms with very fine long teeth, resembling fimbriae in the folds, the sides narrow, lateral plates large.

Type locality.—Dead Run, Va.

Type.—Male, No. 28340, U.S.N.M.

Distribution.—VIRGINIA: Dead Run, May 21, 1914 (R. C. Shannon).

SIMULIUM VITTATUM Zetterstedt

Simulium vittatum ZETTERSTEDT, Ins. Lappon. Dipt., 1835, p. 803.
Simulium tribulatum LUGGER, 2d rept. Ent. Minn., 1896, p. 205.
Simulium glaucum COQUILLETT, Proc. U. S. Nat. Mus., vol. 25, 1903, p. 97.
Simulium dahlgrüni ENDERLEIN, Deut. Tierarz. Woch. Hanover, 1921, p. 43; Zool. Anz. vol. 53, p. 45.

Frons and fore coxae dark opaque gray; thorax with five vittae; abdomen pollinose gray, with three rather indefinite dorsal rows of longitudinal black spots; fore tibia yellowish with a large patch of white pollen; claws simple. Hypopygium, cerci rounded quadrate, infuscated, setose; anal lobe broad, infuscated and sparsely setose above, slightly lobed below cerci, roundedly expanded ventrally, clear and finely pilose. Genital rod with the arms wide, slender at tip, quadrately expanded, the outer edge of the expansion chitinized and cuneiform, inner widening membranous, apical widening triangular, infuscated. (figs. 74 and 75.)

Male hypopygium: Side-piece quadrate, longer than wide, with outer basal projection. Clasper stout, truncate, with three terminal teeth; adminiculum broad, membranous, the basal arms short with irregular tips; adminiculum arms with thickened edge and group of

small teeth in bend and margin; lateral expansion large. (figs. 106. 107. and 108.)

Type localities.—Of *vittatum*, probably Lapland, exact locality and present location of type unknown to us.

Of *tribulatum*, Minnesota, exact locality in and present location of type unknown to us.

Of *glaucum*, Kansas City, Mo., type in the U. S. National Museum. Cat. No. 6184, U.S.N.M.

Of *dahlgrüni*, Greenland, type presumably in collection Enderlein.

S. vittatum attacks man and livestock freely. It is a common species in Europe and is widespread throughout North America, occurring nearly as far north as the Arctic Ocean.

Ninety-seven specimens at hand.

Distribution.—ALASKA: Yakutat, June 21, 1899 (T. Kincaid). Popoff Island, July 10, 1899 (T. Kincaid). Katmai, July, 1917 (J. S. Hine).

ARIZONA: Tempe, June 19, 1917 (J. M. Aldrich).

BRITISH COLUMBIA: Taku, July 22, 1919 (H. G. Dyar).

CALIFORNIA: Seneca, March, 1924 (F. J. Silor). Death Valley, April, 1891 (A. Koebele). Claremont (C. F. Baker). Los Angeles, July (D. W. Coquillett). Bridgeport, June 22, 1916 (H. G. Dyar). Fallen Leaf, June 4, 1916 (H. G. Dyar).

COLORADO: Pike's Peak (T. D. A. Cockerell).

GREENLAND: Taserii, August 5, 1890 (W. Lundbeck). Kr'haab, July 31, 1890 (W. Lundbeck).

IDAHO: Moscow, June 19, 1900 (J. M. Aldrich). Julietta, July 16, 1924 (J. M. Aldrich). Hagerman (J. M. Aldrich).

ILLINOIS: Algonquin, May 7, 1913 (W. M. Nason).

INDIANA: La Fayette, April 5 (J. M. Aldrich). Richmond (———).

IOWA: Davenport, May 29, 1916 (J. M. Aldrich).

LABRADOR: Fort Chimo (L. M. Turner). Hawk's Harbor, July 20, 1908 (Peary's North Pole Expedition).

MARYLAND: Forest Glen, April 19, May 10, 1914 (O. Heidemann).

MEXICO: Victoria, Tampico, December 10 (F. C. Bishopp).

MINNESOTA: Grand Rapids, August 18, 1896 (———).

Missouri: Kansas City, April 8, 1899 (C. F. Adams).
Montana: Bozeman, August 7, 1914 (———).
Nevada: Reno, October 8, 1915 (H. G. Dyar).
New York: Niagara Falls, November, 1896 (———).
North Dakota: Minot, July 15, 1921 (H. G. Dyar).
Oregon: Crater Lake, July 28, 1920 (H. G. Dyar).
South Carolina: Spartanburg, June 6–August 14, 1912 (Jennings and King). Greenville, May 15, 1912 (Jennings and King).
South Dakota: Brookings (J. M. Aldrich).
Texas: Sabinal, March 22, 1911 (F. C. Pratt).
Washington: Ritzville, July 31, September 9, 1920 (R. C. Shannon). Oroville, July 21, 1920 (H. G. Dyar).
Wyoming: Mammoth Hot Springs, July 13, 1922 (H. G. Dyar).
Yukon Territory: White Horse, June 29–July 28, 1919 (H. G. Dyar). Selkirk, June 13, 1919 (H. G. Dyar).

SIMULIUM DECORUM Walker

Simulium decorum Walker, Cat. Brit. Mus. Dipt., vol. 1, p. 112, 1848.
Simulium venustoides Hart, 27th Rept. State Ent. Ill., 1912, p. 42.
Simulium piscicidium Malloch (not Riley), U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 46.

A rather large bluish-gray species with legs largely brownish yellow; fifth to ninth tergites of full width, subshining, bluish gray; bases of wings brownish yellow; stem vein white pilose.

Female hypopygium: Much as in *vittatum*. Anal lobe roundedly full below, chitinized and with small setae. Ovipositor flaps approximate at tip and fimbriate, rather short. Arms of genital rod widely divaricate, simple to half way; a chitinized rod and short tooth at apex with chitinization beyond joining the surface membrane (figs. 69 and 70).

Male hypopygium as in *vittatum*, rather darker, the claspers with four teeth. (Figs. 133 and 134.)

Apparently a rather rare species of wide distribution. Three specimens bear the label "biting." According to the dates it appears to be a two-brood species. Twenty-one specimens.

Type localities.—Of *decorum*, Martin Fall, Ontario. Type in the British Museum, examined by the junior author in August, 1925.

Of *venustoides*, Algonquin, Ill. Type presumably in the Illinois State Natural History Laboratory.

Distribution.—ALBERTA: Red Deer, August 2, 1918 (H. G. Dyar).

COLORADO: Boulder (T. D. A. Cockerell).

FLORIDA: (———).

ILLINOIS: Algonquin, May 3, 1895; June 6, 1908; October 17, 1894 (———).

MARYLAND: Plummer Island, April 22, 1903 (R. P. Currie); April 29, 1915 (J. C. Crawford); May 9, 1914 (R. C. Shannon); June 8, 11, 1914 (Schwarz and Shannon); June 28, 1905 (H. S. Barber); November 3, 1901 (H. S. Barber). Near Plummer Island, May 2, 1915, June 3, 1914 (R. C. Shannon).

MICHIGAN: Pine River, September 7, 1896 (H. G. Hubbard).

VIRGINIA: Dead Run, May 28, June 6–20, 1915 (R. C. Shannon).

SIMULIUM DECORUM KATMAI, new subspecies

Differs from *decorum* in having the legs largely blackish and the fifth tergite less distinctly bluish gray.

Female hypopygium: As in *decorum*, but arms of genital rod heavily chitinized outwardly, the tooth very large and broad (figs. 56 and 57).

Male as in *decorum*.

Type locality.—Katmai, Alaska.

Type.—Female, *paratypes* 2 females. Cat. No. 28341, U.S.N.M.

All of our records are from northwestern North America. 19 specimens.

Distribution.—ALASKA: Skagway, August 1, 1919 (H. G. Dyar). Katmai, July, 1919 (H. S. Hine). Ketchikan, August, 1919 (H. G. Dyar). Kukak Bay, July 4, 1899 (T. Kincaid).

YUKON TERRITORY: Carcross, July 21, 1919 (H. G. Dyar). White Horse, June 29, 1919 (H. G. Dyar). Selkirk, June 13, 1919 (H. G. Dyar).

SIMULIUM MERIDIONALE Riley

Simulium meridionale Riley, Rept. Dept. Agr., 1886, p. 513.

An examination of the old material of this species remaining in the collection discloses the fact that it contains two sets of material. Only two females are left of the original type material (described 1886). These have labels in Riley's handwriting "3982 (bred) Mc. 16, '86; type." The second set of specimens, males and females, bearing the same lot number, 3982, also bear a label giving the year 1888 (in Pergande's writing). According to the female genitalia the second series of specimens is a different species. They prove to be conspecific with specimens of the type series of *occidentale* Townsend, hence must go under this name. We have no additional material of the true *meridionale;* while the large number of specimens (210) of this particular group from all but the northeastern parts of North America agree with the *occidentale* form.

General color dark opaque gray; pile entirely pale; frons opaque gray, distinctly narrower than the width of the clypeus; legs black, including fore coxae, mesonotum trivittate; abdominal pile rather dense and conspicuous, pale; second to sixth tergites greatly reduced, opaque dark gray, the dark coloring extending outward and merging with the grayish venter; remaining tergites of nearly full width, grayish pruinose; claws with the base greatly produced, making them appear bifid; stem vein pale pilose.

Cerci rounded, quadrate, infuscated, setose; anal lobe similar, arcuate, moderate; ovipositor flaps membranous, the tips separated. Genital rod with the forks triangularly expanded beyond the middle, a very slight tooth on the outer side of the arm at the expansion. (Figs. 62 and 63.)

No males are at hand.

Type locality.—Probably Lake View, Miss. One of the two specimens marked "type (bred)" bears the date March 16, 1886, the other is undated. In the notes under No. 3892, the first entry is dated March 26, 1886; "Received from O. Lugger, Lake View, Miss., some small larvae of *Simulium.*" More material is recorded March 31, April 3 and 6, 1886, all from the same source, and in the last entry the receipt of a bred adult is mentioned, probably one of the types before us. Type, Cat. No. 773, U.S.N.M.

SIMULIUM OCCIDENTALE Townsend

Simulium occidentale Townsend, Psyche, vol. 6, 1891, p. 107.

Simulium tamaulipense Townsend, Journ. N. Y. Ent Soc., vol. 5, 1897, p. 171.

Simulium forbesi Malloch, U. S. Dept. Agr., Bur. Ent., Tech. ser. No. 26, 1914, p. 50.

Simulium meridionale Malloch (not Riley), U. S. Dept. Agr., Bur. Ent., Tech ser. No. 26, 1914, p. 50.

Externally the species agrees in color and structure with *meridionale*. Cerci rounded quadrate, infuscated, setose. Anal lobe similar, arcuate, moderate, the ventral edge slightly chitinized and irregular. Ovipositor flaps membranous, angular, the tips separated. Genital rod with the forks at right angles, pale to middle, a long chitinous tooth from the base of a similar rod that runs to tip of arm; a triangular flap at the tip. (Figs. 63*a* and 64.)

Male hypopygium: Side-piece longer than broad, outer tip shouldered. Clasper uniform tapered, with small terminal spine. Adminiculum broad, membranous, shallowy emarginate centrally, subpilose. Adminiculum arms with 3 very large teeth on each side, with fimbriae between: lateral plate slight. (Figs. 131 and 132.)

S. occidentale, also called "cholera gnat" and "turkey gnat," is one of our commonest and widest distributed species. In former years (about 1888) it was believed to have caused the death of thousands of chickens and turkeys yearly in Virginia by giving them cholera. It bites man and livestock freely (Townsend).

Type localities.—Of *occidentale*, Rio Grande Valley, N. Mex. Present location of type unknown to us.

Of *tamaulipense*, Tamaulipas, Mexico. Present location of type unknown to us.

Of *forbesi*, Havana, Ill. Type presumably in the State Natural History Laboratory.

Two hundred and twelve specimens at hand. No material in the collection from Northeastern America, although it is reported from New York (Johannsen).

Distribution.—ALASKA: Skagway, June 4, 1919 (Harrington).

CALIFORNIA: Tahoe City, June 14, 1920 (H. G Dyar).

DISTRICT OF COLUMBIA: Washington, May 16, (F Knab).

FLORIDA: Jacksonville (T. A. Slosson).

GEORGIA: Oxford, March 29, 1915 (Wilson Gee). Myrtle, April 3, 1916 (A. A. Girault). Cornelia, May 3, 1916 (W. W. Chase).

IDAHO: Idaho Falls, July 18, 1922 (H. G. Dyar).

ILLINOIS: Havana (A. W. Jobbins-Pomeroy). Urbana, November 13, 1915 (———). Meredosia, May 28, 1917 (———). Galena, June 29. 1892 (C. A. Hart).

INDIANA: Pine Creek, May 18, 1917 (J. M. Aldrich).

KANSAS: Lawrence (J. M. Aldrich).

LOUISIANA: Friersons Mill, March 16, 1886, May 7, 1888; December 24, 1889 (G. A. Frierson). Ashwood, May 2, 1888 (F. M. Webster). Logansport, March 24, 1922 (Tucker and Jones). Baton Rouge, May 19 (T. H. Jones). Tallulah, June 2, 1922 (W. V. King). Mound, May 27, 1922 (W. V. King).

MANITOBA: Napinka, June 20, 1907 (F. Knab).

MISSISSIPPI: Natchez, May 16, 1909 (E. S. Tucker). Agricultural College, April 1897 (H. E. Weed).

MISSOURI: St. Louis, May 6, 1904 (W. V. Warner).

MONTANA: Two Medicine River, July 27, 1921 (H. G. Dyar). Rainbow Falls, July 9, 1921 (H. G. Dyar). Saco, July 10, 1921 (H. G. Dyar). Great Falls, July 6–7, 1921, (H. G. Dyar). Glasgow, July 11, 1921 (H. G. Dyar). Havre, July 10, 1921 (H. G. Dyar).

NEW MEXICO: Las Cruces, May 19 (C. H. T. Townsend).

NORTH DAKOTA: Mandan, June 16, 1922 (H. G. Dyar). Grand Forks, June 23, 1918 (———). Fargo, June 13, 1922 (H. G. Dyar).

SOUTH CAROLINA: Abbeville, March 22, 1912 (Jennings and King). Greenwood, March 15, 1912 (Jennings and King). Ninety Six, March 19, 1912 (Jennings and King). Union, May 10, 1915 (T. P. Kennedy).

TENNESSEE: Knoxville, March 25, 1912 (E. C. Cotton).

TEXAS: Liberty, March 19, 1908 (E. S. Tucker). Dallas, June 2, 1922 (F. C. Bishopp). (Belfrage.)

SIMULIUM SLOSSONAE, new species

Simulium jenningsi MALLOCH (part), U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1924, p. 42.

Agrees with *meridionale* in having the base of the claws greatly produced; also the female hypopygium shows great similarity to the *meridionale* type. Externally the females are so close in appearance to *perissum* and small specimens of *venustum* that one must rely on the structure of the claws for their separation. Body shining black; frons shining, as broad as the clypeus; fore coxae yellowish; legs bicolored; tergites before the sixth greatly reduced, opaque black, remaining tergites shining black; abdominal pile very sparse, pale; stem vein black pilose.

Cerci rounded quadrate, infuscated, setose. Anal lobe more chitinized than cerci, as dark as abdominal sclerites, narrowing ventrally and roundedly ended. Forks of genital rod weak but broad, widely roundedly triangularly expanded outwardly, the edges narrow, dark; a small blunt point present on outer margin; tip of margin waved. (Figs. 58 and 59.)

Male hypopygium: Side pieces quadrate, stout, wider than long. Clasper uniform, twice as long as side piece, with a short rounded branch near base; a tubercle at tip. Adminiculum arched, thin central area strongly protuberant, pilose, adminiculum arms with a row of dense sharp teeth on each side, mixed with fimbriae; lateral plates conical, lined. (Figs. 124 and 125.)

Type locality.—Biscayne Bay, Fla.

Type.—Male, *paratypes* 7 females, Cat. No. 28342, U.S.N.M..

Distribution.—Florida: Biscayne Bay (A. T. Slosson; H. G. Hubbard).

South Carolina: Columbia, May 14, 1912 (Jennings and King). Congaree, Apr. 15, 1912 (Jennings and King).

SIMULIUM GRISEUM Coquillett

Simulium griseum Coquillett, Bull. 10, n. ser., Div. Ent., U. S. Dept. Agr., 1898, p. 69.

Thorax gray brown to grayish yellow, the median stripe very indistinct; legs yellow except the apex of hind tibia and the tarsi in part; abdomen largely yellowish with a median row of black spots on the second to sixth tergites inclusive, the chitin of the sixth tergite reduced to a roundish black spot; last three tergites grayish yellow, shining.

Female hypopygium: Cerci rounded quadrate, infuscated, sparsely setose. Anal lobe broad, pale, setae small and sparse; ventrally triangularly produced to a long sharp point. Arms of genital rod widely expanded, pale, with a long dark tooth at base of rod. (Figs. 90 and 91.)

Male hypopygium: Side pieces longer than wide, rounded quadrate. Clasper longer than side piece, tapered, flattened, a spine at tip. Adminiculum very broadly transverse, 3 times as wide as long, basal prongs stout. Adminiculum arms with long teeth mixed with short ones in the folds; lateral plate fimbriate. (Figs. 94, 95, and 96.)

Coquillett does not record the male in the description of the species, but the single male in the lot, same data, bears the type label, presumably placed there by Coquillett.

Five specimens at hand. One specimen (Pecos, N. M.) bears label "On horse."

Type locality.—Colorado, exact locality not stated. Type in U. S. National Museum, Cat. No. 10381, U.S.N.M.

Distribution.—Colorado: (C. P. Gillette).
New Mexico: Pecos, June 28, 1905? (M. Grabham).

SIMULIUM NOTATUM Adams

Simulium notatum Adams, Kans. Univ. Sci. Bull., vol. 2, 1904, p. 434.

A very small species usually pale yellow with a remarkably arched mesonotum; legs almost entirely yellow except the dark fore tarsi; antennae almost entirely yellow. Female hypopygium. Cerci rounded, weakly infuscated. Anal lobe very pale, a sharp projection below cerci, drawn out ventrally to an angular point which is finely hirsute. Genital rod as in *griseum* but weakly chitinized. (Figs. 88 and 89.)

Male hypopygium. Side pieces quadrate, a little longer than broad; clasper tapered, uniform, moderate, a spine at tip. Adminiculum broad, arched, membranous, basal prongs short and slender. Adminiculum arms with a long row of long and short teeth, lateral expansion weak but rather large. (Figs. 117 and 118.)

Four specimens.

Type locality.—Williams Fork, Ariz. Type presumably in the collection of the University of Kansas.

Distribution.—New Mexico: Las Cruces, June 25, 1895 (T. D. A. Cockerell).
Texas: Devil's River, May 6, 1907 (F. C. Pratt).

SIMULIUM VENATOR, new species

Mesonotum entirely light pollinose except for a distinct brownish median stripe, scutellum yellowish; tergites 3, 4, 5, and 6 with central black spots; legs mostly yellowish. Female hypopygium. As in *distinctum*, but the ventral process of the ninth segment is shorter, being less than the length of the body of the sclerite. (Figs. 92 and 93.)

Male hypopygium as in *distinctum*.

Type locality.—Reno, Nev.

Type.—Female, *allotype* male, *paratypes* 13 females, Cat. No. 28343, U.S.N.M.

Distribution.—California: Inyo County (A. Davidson).
Idaho: Idaho Falls, July 18, 1922 (H. G. Dyar). Moscow, June 16, 1910 (J. M. Aldrich).
Montana: Great Falls, July 7, 1921 (H. G. Dyar).
Nevada: Reno, July 7, 1916 (H. G. Dyar). Steamboat, September 3, 1915 (H. G. Dyar).

SIMULIUM MEDIOVITTATUM Knab

Simulium mediovittatum KNAB, Ins. Ins. Mens., vol. 3, 1916, p. 77.

Very close to *venator*, but of a general darker color, the scutellum blackish, legs more extensively black, second tergite with a central black spot.

Female hypopygium exactly as in *haematopotum*.

Thirteen specimens at hand.

Type locality.—Arlington, Tex. Type in U. S. National Museum, Cat. No. 19635, U.S.N.M.

Distribution.—TEXAS: Arlington, October 28, 1914 (F. C. Bishopp). Bay City, January 26, 1911 (C. T. Atkinson).

SIMULIUM BIVITTATUM Malloch

Simulium bivittatum MALLOCH, U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 31.

The mesonotum shows seven distinct stripes including the pale lateral which are alternating pale pollinose and orange colored.

Female hypopygium as in *notatum* exactly.

Ten specimens at hand.

Type locality.—East Las Vegas, N. Mex. Type in U. S. National Museum, Cat. No. 15415, U.S.N.M.

Distribution.—COLORADO: Virginia Dale, September 31, 1912 (F. C. Bishopp). August 17, 1906 (———).
MONTANA: Great Falls, July 7, 1921 (H. G. Dyar).
NEW MEXICO: East Las Vegas, June 1, 1901 (T. D. A. Cockerell). Las Vegas Hot Springs, August 19, 1901 (H. S. Barber).

SIMULIUM TRIVITTATUM Malloch

Simulium trivittatum MALLOCH, U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 30.

Simulium distinctum MALLOCH, U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 30.

The seven stripes of the mesonotum are alternating pale pollinose and black, the stripes of nearly equal width.

Female hypopygium. Cerci infuscated, sparsely setose, anal lobe roundly produced, with a long fringe-shaped ventral process, finely pilose at tip; anterior margin of segment infuscated. Eighth sternite plate dark and coarsely setose. Genital rod dark, the arms pale, triangularly widened, a chitinized rod beyond with a tooth from its base. (Figs. 78 and 79.) Male hypopygium as in *notatum*. (Figs. 115 and 116.)

Seven specimens at hand.

Type localities.—Of *trivittatum*, Tampico, Mexico. Type in the U. S. National Museum, Cat. No. 15408, U.S.N.M.

Of *distinctum*, Devils River, Texas. Type in U. S. National Museum, Cat. No. 15958, U.S.N.M.

Distribution.—Mexico: Tampico, December 17 (E. A. Schwarz). Texas: Devils River, May 5, 1907 (Bishopp and Pratt). Victoria, December 13 (F. C. Bishopp).

SIMULIUM HAEMATOPOTUM Malloch

Simulium haematopotum Malloch, U. S. Dept Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 62.

This species is easily characterized by the pearlaceous mesonotal color, alternating with black stripes. The lateral pair are rather broad and not sharply separated from the black stripes. The mesonotal pile is brassy and the frons and clypeus pearlaceous.

Female hypopygium. Cerci rounded quadrate, infuscated, setose. Anal lobe rather small, infuscated, very sparsely setose, some coarse. The ventral area produced with a small round point with fine pile. A dorsal chitinized plate. Ovipositor flaps weak, but marked on their inner angles with dark fimbriate lines; eighth segment heavily chitinized, coarsely setose. Genital rod as in the foregoing (figs. 86 and 87) (*notatum* and others).

Thirteen specimens.

Type locality.—Vera Cruz, Mexico. Type in U. S. National Museum, Cat. No. 15414, U.S.N.M.

Distribution.—Cuba: Cayamas, January 6 (E. A. Schwarz).

Guatemala: Polochic River, March 22, 1906 (H. S. Barber).

Mexico: Santa Lucrecia, October, 1911 (F. W. Urich). Chiapa de Corzo, October, 1925 (A. L. Herrera).

Porto Rico: Rio Piedras, January 24, 1912 (T. H. Jones).

SIMULIUM PIPERI, new species

Male.—Entirely black, including legs; anterior half of mesonotum faintly and diffusely pale pollinose; thoracic pile brassy; scutellum fringed with black hairs; stem vein black pilose.

Hypopygium: Side pieces quadrate, short; clasper thick at base, excavately tapered, twice as long as side piece, a spine at tip. Adminiculum broad, arched, pilose, the basal prongs stout, rather

long, black; adminiculum arms with three long sharp teeth on each side, well spaced, with one or two little teeth and fimbriae between; a thin spotted membrane. (Figs. 129 and 130.)

Type locality.—Seattle, Wash.

Type.—Cat. No. 28344. U.S.N.M.

Distribution.—WASHINGTON: Seattle (C. V. Piper).

SIMULIUM VIRGATUM Coquillett

Simulium virgatum COQUILLETT, Proc. U. S. Nat. Mus., vol. 25, 1903, p. 87.
Simulium hippovorum MALLOCH, U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 28.
Simulium rubicundulum KNAB, Ins. Ins. Mens., vol. 2, 1914, p. 178.

A fairly large species; fore coxae yellow, frons grayish opaque; eyes deeply incised; tergites two to six, very small; last three bluish gray, faintly obscured with pollen; fore tibia with a distinct patch of white pollen; fore tarsi slightly thickened, legs mostly yellow; mesonotum with tinge of reddish brown. Mesopleura usually bare but sometimes with a few loose hairs on upper margin.

Female hypopygium with anal lobe narrow, and a single row of coarse setae; forks of genital rod shaped like a spear-head, heavily chitinized and broad, both teeth dark as well as the curved tips. (Figs. 82 and 83.)

Male hypopygium: Side pieces short, outer angle produced. Claspers heavy and broad, rounded, constricted subapically with terminal minute tubercle; adminiculum broad, membranous, with wide basal arms, the center quadrately produced to form an I-shaped bar which crosses the disk and widens at base. Adminiculum arms ridged, subdentate, with a spotted membrane. (Figs. 126, 127, and 128.)

Fifty specimens at hand.

Type localities.—Of *virgatum*, Las Vegas Hot Springs, N. Mex. Type in U. S. National Museum, Cat. No. 6183, U.S.N.M

Of *hippovorum*, Sierra Madre, Mexico. Type in U. S. National Museum, Cat. No. 15407, U.S.N.M.

Of *rubicundulum*, Cordoba, Mexico. Type in U. S. National Museum, Cat. No. 19112, U.S.N.M.

Distribution.—CALIFORNIA: Los Angeles, June–July (W. D. Coquillett). Fresno, May 12, 1923 (M. E. Phillips). East Highlands, October, 1914 (———). Clio, July 9, 1916 (H. G. Dyar). Truckee, August, 8, 1915 (H. G. Dyar).

MEXICO: Sierra Madre, Chihuahua, July 27 (C. H. T. Townsend). Cordoba, December 17, 1907 (F. Knab).
NEW MEXICO: Las Vegas, July 8–August 14, 1901 (H. S. Barber).
SOUTH DAKOTA: Hot Springs (———).
TEXAS: Devils River, May 5, 1907 (F. C. Pratt).

SIMULIUM HUNTERI Malloch

Simulium hunteri MALLOCH, U. S. Dept. Agr., Bur. Ent., Ser., No. 26, 1914, p. 59.

A fairly large species, fore coxae yellow; frons shining; eyes less conspicuously incised than in *virgatum;* three distinct mesonotal vittae; fore tibia with whitish pollinose patch; fore tarsi broadened; last four tergites shining black. Ovipositor: Similar to *pictipes.* Anal lobe curved posteriorly, truncate tipped, chitinized before, infuscated behind. Arms of genital rod with rounded dark tooth centrally, the apex broadly expanded and darkly colored. (Figs. 71 and 72.)

No male. A widely distributed western species. The type series bear the label "On cow." Twenty-eight specimens.

Type locality.—Virginia Dale, Colo. Type in U. S. National Museum, Cat. No. 15415, U.S.N.M.

Distribution.—ALASKA: Seward, July 25, 1921 (J. M. Aldrich).
BRITISH COLUMBIA: Ainsworth, July 11, 1903 (A. N. Caudell). Glenora (H. F. Wichkam). Laggan, August, 1906 (Dyar and Caudell). Kwinitsa, August 14, 1919 (H. G. Dyar).
COLORADO: Virginia Dale, September 31, 1912 (F. C. Bishopp).
NEW MEXICO: Beulah, August 15 (T. D. A. Cockerell). Havey's Ranch, 10,000 feet, August 28, 1916 (C. H. T. Townsend).

SIMULIUM SAYI, new species

Simulium hunteri MALLOCH (part), U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, p. 59.

A medium-sized species distinguished from others of the group by the dark coxae; grayish opaque frons; dark legs, the basal parts of mid and hind basitarsi and basal parts of hind second tarsus yellowish; no pollinose patch on the fore tibia and slender fore tarsi; last four tergites shining. *S. hunteri* has the fore coxae yellow, the frons shining, the fore tibia with a pollinose patch and the fore tarsi broadened. Female hypopygium: Similar to *hunteri;*

anal lobe more pointed ventrally, more evenly infuscated, the arm of the genital rod with a long sharp tooth centrally. (Figs. 67 and 68.)

Three females taken "on cow."

Type locality.—Virginia Dale, Colo.

Type.—Female, *paratypes* two females. Cat. No. 28345, U.S.N.M.

Distribution.—COLORADO: Virginia Dale, September 31, 1912 (F. C. Bishopp).

SIMULIUM METALLICUM Bellardi

Simulium metallicum BELLARDI, Saggio Ditter. Mess., vol. 1, 1859, p. 14.

A rather small species easily distinguished by its pearlaceous mesonotum with 3 distinct vittae; parallel sided, shining black frons; pearlaceous clypeus; yellow coxae; bicolored legs and toothed claws.

Female hypopygium: Cerci rounded quadrate, infuscated, setose, anal lobe with a dorsal plate; sclerites ventrally rounded, triangular, more heavily chitinized than cerci, setose, curved back, truncate tipped, equaling the cerci. Arms of genital rod with chitinization and smaller tooth outwardly. (Figs. 72*a* and 73.)

No males. Thirty specimens.

Type locality.—Mexico, exact locality unknown. The type may be in Florence, Italy.

Distribution.—COSTA RICA: San José (F. Knab).

GUATEMALA: Cacao, Trece Aguas, March 27, (H. S. Barber).

MEXICO: Nogales (C. H. T. Townsend). Cordoba, December 21, 1907 (F. Knab).

TRINIDAD: Mendoza, August 24, 1908 (F. W. Urich).

SIMULIUM PARNASSUM Malloch

Simulium parnassum MALLOCH, U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 36.

A medium sized blackish species with shining frons, yellowish coxae; fore tibia with scarcely a trace of the white pollinose patch; claws toothed; mesonotum and stem vein black pilose. Hypopygium exactly as in *arcticum* Malloch. (Figs. 65 and 66.) Male hypopygium. Sidepieces short, shouldered at an acute angle. Clasper stout, uniform, twice as long as sidepiece, a spine at tip. Adminiculum with large oblique basal arms from an elliptical lacuna, the tip narrow, overlined by a triangular membrane with long hirsute tip. Adminiculum arms strongly margined with several long teeth in the folds mixed with numerous fimbriae; lateral plates large, fimbriate. (Figs. 103, 104, and 105.)

This species attacks man freely. Thirty-five specimens.

Type locality.—Red Hill, Moultonburgh, N. H. Type in U. S. National Museum, Cat. No. 15409, U.S.N.M.

Distribution.—MARYLAND: Plummers Island, May 9, 1914 (R. C. Shannon); June 8, 1914 (Schwarz and Shannon).

NEW HAMPSHIRE: Red Hill, August 5, 1902 (H. G. Dyar). White Mountains (H. K. Morrison).

NEW YORK: Plattsburg, August 18, 1904 (H. G. Dyar).

VIRGINIA: Skyland, July 19, 1912 (H. G. Dyar). Dead Run, May 23, 1915 (R. C. Shannon).

SIMULIUM ARCTICUM Malloch

Simulium arcticum MALLOCH, U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1917, p. 37.

Simulium hunteri MALLOCH (part), U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 59.

Simulium simile MALLOCH, Canad. Arctic Exp., 1913–1918, vol. 3, 1919, p. 42c.

Simulium simile CAMERON, Dom. Canada, Dept. Agr., Bull. No. 5, n. ser. 1922.

A species of variable size with pale pilosity, two large pale pollinose spots connected with a median one on anterior mesonotum; shining frons; yellowish coxae; bicolored legs with a very distinct patch of silvery pollen on fore tibia. Hypopygium as in *venustum*, but anal lobe broadly rounded below and bluntly pointed, finely pilose; chitinized in spots; arms of genital rod with a very large truncate tooth centrally. (Figs. 80 and 81.)

Male hypopygium as in *venustum* but head of adminiculum more coarsely spinose, teeth of adminiculum arms few, long, and widely spaced, only in the angles; lateral plates large, fimbriate. (Figs. 109 and 110.)

An abundant species in the Northwest. Cameron has recently reported it (as *simile*) as a severe pest to cattle in the Saskatchewan region and gives an extended account of its morphology and biology with figures. It is also an exceedingly annoying species to man. Two hundred and forty specimens.

Type localities.—Of *arcticum*, Kaslo, British Columbia. Type in U. S. National Museum, Cat. No. 15410, U.S.N.M.

Of *simile*, Arctic Sound, Canada. Type in the Canadian National Collection.

Distribution.—ALASKA: Camp 327, Alaska Eng. Com. July 12, 1921 (J. M. Aldrich). Healy, July 7, 1921 (J. M. Aldrich).

ALBERTA: Banff, July 13, 1918 (H. G. Dyar).

British Columbia: Kaslo, July 4, 1903 (R. P. Currie). Lake Atlin, July 27, 1919 (H. G. Dyar). Kokanee Mountain, August 10, 1903 (H. G. Dyar). London Hill Mine, July 21, 1903 (R. P. Currie). Lillooet (2302). Hazelton, September 5, 1919 (H. G. Dyar).

California: Clio, July 9, 1916 (H. G. Dyar). Fallen Leaf, June 4, 1916 (H. G. Dyar). Gold Lake, July 19, 1916 (H. G. Dyar).

Colorado: Virginia Dale, September 31, 1912 (F. C. Bishopp). Fraser River, June 26, 1923 (H. G. Dyar). Peetz, July 13, 1921 (G. A. Sandhouse).

Idaho: Moscow, April 8, 1913 (J. M. Aldrich). Marsh (J. M. Aldrich). Albion (J. M. Aldrich). Lahwai, March 27, 1909 (J. M. Aldrich). Gospel Mountain, July 12, 1907 (J. M. Aldrich).

Montana: Great Falls, July 7, 1921 (H. G. Dyar). Rainbow Falls, July 9, 1921 (H. G. Dyar). Belton, June 19, 1921 (H. G. Dyar). Cut Bank, July 5, 1921 (H. G. Dyar).

Nevada: Reno, October 8, 1915 (W. R. Munroe).

Oregon: Detroit, May 20, 1924 (H. G. Dyar).

Saskatchewan: Rothern, June 1, 1915, (W. R. Munroe).

Washington: Glacier, June 4, 1917 (H. G. Dyar), Longmire Springs, August 2, 1905 (J. M. Aldrich). Ritzville, July, 1920 (R. C. Shannon). Yakima, December, 1919, larvae and pupae (J. M. Aldrich).

Wyoming: Old Faithful, June 29, 1922 (H. G. Dyar).

Yukon Territory: Selkirk, June 13, 1919 (H. G. Dyar). Dawson, September 8, 1912 (J. M. Jessup).

SIMULIUM PERISSUM, new species

Simulium jenningsi, Malloch (part), U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 42.

A medium sized species, very close to *venustum* and very difficult to separate from the typical form. It is somewhat darker, with evidence of three mesonotal vittae; the stem vein is black pilose. Cerci rounded quadrate, infuscated, setose, anal lobe unmodified, setose, with rather broad median chitinized area. Ovipositor flaps weak, remote at tips, slightly embrowned in inner margins. Forks of

genital rod moderate, a long tooth from the base of marginal chitinization that runs to apex. (Figs. 84 and 85.)

Male hypopygium. Side piece wider than long, setose only at outer rim, clasper twice as long as side piece, with a short rounded spinose arm near base; a spine at tip. Adminiculum transverse quadrate, heavily chitinized on margins and long basal prongs. margin emarginate, denticulate. Adminiculum arms with a row of close teeth mixed with fimbriae; lateral plates moderate. (Figs. 119 and 120.) The male hypopygium is very similar to that of the European *S. tuberosum* Lundstrom, except for the spines on the lobe of side piece.

Near *slossonae*, the arms of the claspers spinose instead of pilose, the adminiculum more chitinized and quadrate.

Type locality.—Dead Run, Fairfax County, Va.

Type.—Male, *paratypes* thirteen males and females, Cat. No. 28346, U.S.N.M.

The larvae and pupae live in the swift waters of Dead Run stream just where it begins its descent over a precipitous rocky hillside.

Thirty-five specimens.

Distribution.—Maryland: Forest Glen, May 18, 1914 (O. Heidemann). Plummers Island, June 5, 1903 (W. V. Warner).

South Carolina: Gramlin, August 20, 1912 (Jennings and King). Columbia, May 14, 1912 (Jennings and King). Ninety Six, April 19 (Jennings and King).

Virginia: Dead Run, Fairfax County, April, 1925 (R. C. Shannon).

SIMULIUM VANDALICUM, new species

Male hypopygium: As in *perissum*, but the basal branch of the clasper is reduced to a narrow, heavily spinose ridge. (Figs. 111 and 112.) Females from the same locality and collecting are indistinguishable from *venustum*.

Eleven specimens.

Type locality.—Fallen Leaf, Calif.

Type.—Male, *paratypes* 6 females, Cat. No. 28347, U.S.N.M.

Distribution.—California: Fallen Leaf, June 28, 1916 (H. G. Dyar), July 17, 1917 (———). Lake Tahoe, June 13, 1920 (H. G. Dyar). Summit, Placer County, July 19, 1915 (H. G. Dyar). Lily Lake, June 8, 1916 (H. G. Dyar).

SIMULIUM JACUMBAE, new species

Male hypopygium: Side piece short, wider than long, oblique, a long basal projection outwardly. Clasper very long, curved, flat-

tened, a spine at tip, a small compressed spinose projection at base. Adminiculum conic, rounded, smooth, heavily chitinized, the large basal prongs oblique, resembling a bishop's hat. Adminiculum arms with close spines at the outfolds, mixed with fimbriae; lateral plates large, lined. (Figs. 113 and 114.)

Type locality.—Jacumba Springs, Calif.

Type.—Cat. No. 28348, U.S.N.M.

Distribution.—CALIFORNIA: Jacumba Springs (E. A. McGregor).

SIMULIUM VENUSTUM Say

Simulium venustum SAY, Journ. Acad. Sci. Phila., vol. 3, 1829, p. 28.
Simulium piscicidium RILEY, Amer. Ent., vol. 2, 1870, p. 367.
Simulium molestum HARRIS, Insec. Inj. to Veg., ed. 3, 1862, p. 601.
Simulium irritatum LUGGER, 2d Rept. Ent. Minn., 1896, p. 177.
Simulium minutum LUGGER, 2d Rept. Ent. Minn., 1896, p. 177.
Simulium jenningsi MALLOCH (part), U. S. Dept. Agr., Bur. Ent., Tech. Ser. No. 26, 1914, p. 41.
Simulium rileyana ENDERLEIN, Konowia, vol. 1, 1922, p. 75.
Simulium reptans IMMS (not Linnaeus), Text Book of Entomology, 1925, p. 625.

A variable species in size, small to rather large, and variable in coloring. Frons shining, as broad as clypeus; fore coxae yellowish; legs bicolored, the tibiae with distinct silvery pollinose patches; fore tarsi broadened; claws simple; tergites, six to nine, shining; preceding ones opaque black with greatly reduced tergites. The form described as *jenningsi* Malloch has the sides of the mesonotum distinctly pearlaceous.

Femle hypopygium: Cerci rounded quadrate, infuscated, setose, ninth segment rather broad, uniformly chitinized centrally, setose, the ventral area slightly truncately produced and with fine seta. Arms of genital rod divaricate, thickened outwardly, and forming irregular dentation of two or three truncate or blunt teeth. (Figs. 76 and 77.)

Male hypopygium: Side piece rounded quadrate, wider than long. Clasper twice as long as side piece, thick, rounded, a little constricted outwardly, with sharp terminal spine. Adminiculum short, square, with minute denticles at tip, the basal prongs divaricate, thick, truncate tipped. Adminiculum arms with many long teeth mixed with fimbriae, lateral plates quadrate, produced at one angle. (Figs. 97, 98, and 99.)

Extremely abundant throughout North America, probably extending into the Arctic Circle. In California, two closely allied species *vandalicum* and *jacumbae* take its place. In some regions it is exceedingly annoying to man and animals. Nearly a thousand specimens at hand. Closely allied to the European *reptans* Linnaeus, but distinct on details of the hypopygium of both sexes.

It appears that Riley's material of *piscicidium* was mixed (No. 390), his adults being *venustum*, but the larvae *decorum*.

Type localities.—Of *venustum*, Shippingsport, Ohio. The type is lost.

Of *piscicidium*, Mumford, New York. Type in U. S. National Museum, Cat. No. 771, U.S.N.M.

Of *molestum*, probably Massachusetts. The type may be in the collection of the Boston Society of Natural History.

Of *minutum*, Minnesota; exact locality and location of type unknown to us.

Of *jenningsi*, Plummers Island, Maryland. Type in U. S. National Museum, Cat. No. 15412, U.S.N.M.

Of *rileyana*, Long Lake, New York. Type presumably in collection Enderlein.

Distribution.—ALASKA: Ketchikan, August 6, 1919 (H. G. Dyar). Metlakahtla, May 6, 1899 (T. Kincaid). Popoff Island, July 9, 1899 (T. Kincaid). Seward, July 25, 1921 (J. M. Aldrich). Camp 327, July 31, 1921 (J. M. Aldrich).

ALBERTA: Medicine Hat, October, 1911 (J. R. Malloch).

BRITISH COLUMBIA: Prince Rupert, August 16, 1919 (H. G. Dyar). Lake Atlin, July 26, 1919 (H. G. Dyar). Bear Lake, July 20, 1903 (R. P. Currie).

COLORADO: Tennessee Pass, July 23, 1917 (J. M. Aldrich).

FLORIDA: Biscayne Bay (A. T. Slosson); May 9–29, (H. G. Hubbard).

IDAHO: Moscow, July 2, 1912 (J. M. Aldrich). Gospel Mountains, July 12, 1907 (J. M. Aldrich). Lewiston, June 1, 1904 (J. M. Aldrich).

ILLINOIS: Algonquin, May 18, 1913 (Q. A. Nason). Dubois, April 24, 1914 (———). Urbana, May 6, 1916 (———). White Heath, May 8, 1915 (———).

INDIANA: LaFayette, October 14 (J. M. Aldrich).

IOWA: Davenport, May 29, 1916 (J. M. Aldrich).

LOUISIANA: Friersons Mills, May 6, 1889 (J. A. Frierson).

MARYLAND: Plummers Island, May 23, 1914 (R. C. Shannon). Forest Glen, May 18, 1914 (O. Heidemann). Chevy Chase Lake, July 4, 1907

(F. Knab). Beltsville, September 26, 1911 (F. Knab). Cabin John, May 16, 1909 (F. Knab).

MASSACHUSETTS: Wilbraham, June 4, 1903 (F. Knab).

MICHIGAN: Battle Creek (J. M. Aldrich).

MISSISSIPPI: Lake View, April 10, 1886 (C. V. Riley).

MISSOURI: St. Louis, May 6, 1904 (W. V. Warner).

MONTANA: Two Medicine River, July 27, 1921 (H. G. Dyar).

NEW HAMPSHIRE: Franconia (A. T. Slosson). White Mountains (H. K. Morrison).

NEW JERSEY: Ramsey, July 30, 1912 (J. R. Malloch). New Lisbon, May 25, 1924 (C. H. Halloch).

NEW YORK: Ithaca (———). Plattsburg, August 2–11, 1904 (H. G. Dyar). Axton, June 12–22, 1907 (A. D. Mac Gillivray). Moody, August 11, 1904 (H. G. Dyar).

NORTH CAROLINA: Flat Rock, June 6, 1912 (A. H. Jennings).

ONTARIO: Waubamic, June 4, 1915 (J. M. Aldrich). White River, June 26, 1907 (F. Knab). Pine River, September 7, 1896 (H. G. Hubbard).

SASKATCHEWAN: Oxbow, May 18, 1907 (F. Knab). Saskatoon, September 16, 1919 (H. G. Dyar).

SOUTH CAROLINA: Spartanburg, July 19, 1913 (A. W. Jobbins-Pomeroy). Abbeville, March 2, 1912 (Jennings and King). Congaree, March 17, 1912 (Jennings and King). Inman, August 9, 1912 (A. H. Jennings). Columbia, May 20, 1912 (Jennings and King). Greenwood, October 9, 1912 (Jennings and King). Gramtin, August 20, 1912 (Jennings and King). Anderson, May 17, 1912 (Jennings and King).

TEXAS: September, 1873 (A. H. R. Bryant).

VIRGINIA: Appomatox, August 11, 1910 (G. A. Runner). Dead Run, March 27, 1925 (R. C. Shannon). Falls Church, June 2, 1914 (O. Heideman). Chain Bridge, July 20, 1912 (F. Knab). Black Pond, October 3, 1924 (H. S. Barber). Spring Hill, September 21, 1911 (F. Knab). Great Falls, June 10, 1910 (E. W. Wall).

WASHINGTON: Spokane, July 2, 1917 (H. G. Dyar). Glacier, June 4, 1917 (H. G. Dyar).

WEST VIRGINIA: White Sulphur Springs, October 25, 1915 (F. Knab).

WYOMING: Yellowstone Canyon, July 5, 1922 (H. G. Dyar). Old Faithful, June 27, 1922 (H. G. Dyar).

YUKON TERRITORY: White Horse, July 1, 1919 (H. G. Dyar). Carcross, July 21, 1919 (H. G. Dyar).

EXPLANATION OF FIGURES

PLATE 1

A. *Prosimilium hirtipes*. Male genitalia, ventral view.
B. *Prosimilium hirtipes*. Female genitalia, lateral view.
C. *Simulium venustum*. Male genitalia, ventral view.
D. *Simulium venustum*. Male genitalia, viewed from caudal aspect.
E. *Eusimulium frisoni*. *a*. Genital fork; *b*. terminal organs.
F. *Parasimulium furcatum*. Wing.
G. *Simulium* Wing.

PLATE 2

FIG. 1. *Prosimulium magnum* Dyar and Shannon, female ovipositor.
2. The same, genital rod.
3. *Prosimulium exigens* Dyar and Shannon, female ovipositor.
4. The same, genital rod.
5. *Prosimulium dicum* Dyar and Shannon, female ovipositor.
6. The same, genital rod.
7. *Prosimulium dicentum* Dyar and Shannon, female ovipositor.
8. The same, genital rod.
9. *Prosimulium fulvum* Coquillett, female ovipositor.
10. *Prosimulium onychodactylum* Dyar and Shannon, female ovipositor.
11. The same, genital rod.
12. *Prosimulium hirtipes* Fries, female ovipositor.
13. The same, genital rod.

PLATE 3

FIG. 14. *Prosimulium novum* Dyar and Shannon, female ovipositor.
15. The same, genital rod.
16. *Prosimulium pancerastes* Dyar and Shannon, female ovipositor.
17. The same, genital rod.
18. *Prosimulium pleurale* Malloch, genital rod.
19. *Eusimulium johannseni* (Hart), female ninth segment and cerci.
20. *Prosimulium fulvum* Coquillett, male clasper.
21. The same, male adminiculum.
22. *Prosimulium magnum* Dyar and Shannon, male clasper.
23. The same, male adminiculum.
24. *Eusimulium bracteatum* (Coquillett), male clasper.
25. The same, male adminiculum.
26. The same, male adminiculum arms.

27. *Eusimulium obtusum* Dyar and Shannon, male clasper.
28. The same, male adminiculum.
29. The same, male adminiculum arms.
30. *Prosimulium exigens* Dyar and Shannon, male clasper.
31. The same, male adminiculum.
32. *Prosimulium pancerastes* Dyar and Shannon, male clasper.
33. The same, male adminiculum.

PLATE 4

FIG. 34. *Eusimulium mutatum* (Malloch), female ovipositor.
35. The same, genital rod.
36. *Eusimulium permutatum* Dyar and Shannon, female genital rod.
37. *Eusimulium pecuarum* (Riley), female genital rod.
38. *Eusimulium clarum* Dyar and Shannon, female genital rod.
39. *Eusimulium minus* Dyar and Shannon, female genital rod.
40. *Eusimulium canonicolum* Dyar and Shannon, female genital rod.
41. *Eusimulium ochraceum* (Walker), female genital rod.
42. *Eusimulium johannseni* (Hart), female genital rod.
43. *Eusimulium borcale* (Malloch), female genital rod.
44. *Eusimulium aureum* (Fries), female genital rod.
45. *Eusimulium congarcenarum* Dyar and Shannon, female genital rod.
46. *Eusimulium mexicanum* (Bellardi), female genital rod.
47. *Eusimulium alticolum* Dyar and Shannon, female genital rod.
48. *Eusimulium dacoicnse* Dyar and Shannon, female genital rod.
49. The same, male clasper.
50. The same, male adminiculum.
51. The same, male adminiculum arms.
52. *Eusimulium clarum* Dyar and Shannon, male clasper.
53. The same, male adminiculum and arms.
54. *Eusimulium johannseni* (Hart), male clasper.
55. The same, male adminiculum (above) and arms (below).

PLATE 5

FIG. 56. *Simulium katmai* Dyar and Shannon, female ninth segment and cerci.
57. The same, genital rod.
58. *Simulium slossonae* Dyar and Shannon, female ninth segment and cerci.
59. The same, genital rod.
60. *Simulium pictipes* Hagen, female ninth segment and cerci.
61. The same, genital rod.
62. *Simulium meridionale* Riley, female ninth segment and cerci.
63. The same, genital rod.
63*a*. *Simulium occidentale* Townsend, female ovipositor.
64. The same, genital rod.
65. *Simulium parnassum* Malloch, female ninth segment and cerci.
66. The same, genital rod.
67. *Simulium sayi* Dyar and Shannon, female ninth segment and cerci.
68. The same, genital rod.
69. *Simulium decorum* Walker, female ninth segment and cerci.
70. The same, genital rod.
71. *Simulium hunteri* Malloch, female ninth segment and cerci.
72. The same, genital rod.
72*a*. *Simulium metallicum* Bellardi, female ninth segment and cerci.

73. The same, genital rod.
74. *Simulium vittatum* Zetterstedt, female ninth segment and cerci.
75. The same, genital rod.

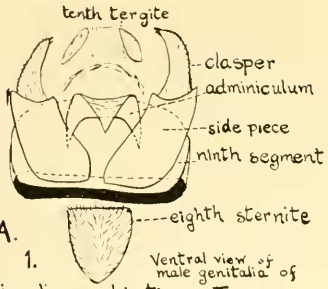
PLATE 6

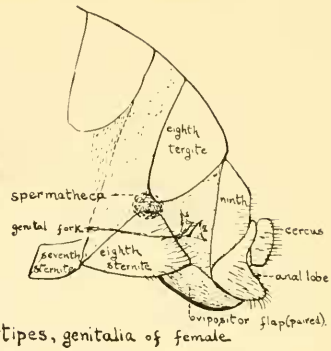
76. *Simulium venustum* Say, female ninth segment and cerci.
77. The same, genital rod.
78. *Simulium trivittatum* Malloch, female ninth segment and cerci.
79. The same, genital rod.
80. *Simulium arcticum* Malloch, female ninth segment and cerci.
81. The same, genital rod.
82. *Simulium virgatum* Coquillett, female ovipositor.
83. The same, genital rod.
84. *Simulium perissum* Dyar and Shannon, female ninth segment and cerci.
85. The same, genital rod.
86. *Simulium haematopotum* Malloch, female ninth segment and cerci.
87. The same, genital rod.
88. *Simulium notatum* Adams, female ninth segment and cerci.
89. The same, genital rod.
90. *Simulium griseum* Coquillett, female ninth segment and cerci.
91. The same, genital rod.
92. *Simulium venator* Dyar and Shannon, female ninth segment and cerci.
93. The same, genital rod.
94. *Simulium griseum* Coquillett, male clasper.
95. The same, male adminiculum.
96. The same, male adminiculum arms.
97. *Simulium venustum* Say, male clasper.
98. The same, male adminiculum.
99. The same, male adminiculum arms.
100. *Simulium pictipes* Hagen, male clasper.
101. The same, male adminiculum.
102. The same, male adminiculum arms.
103. *Simulium parnassum* Malloch, male clasper.
104. The same, male adminiculum.
105. The same, male adminiculum.

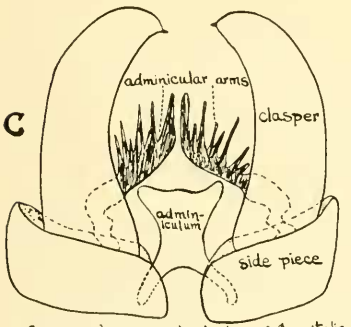
PLATE 7

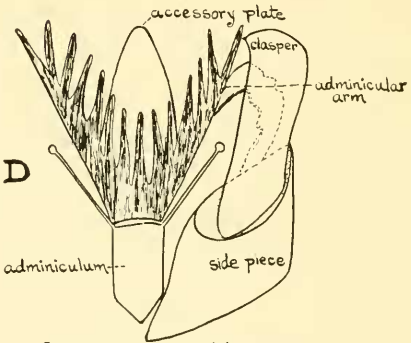
106. *Simulium vittatum* Zetterstedt, male clasper.
107. The same, male adminiculum.
108. The same, male adminiculum arms.
109. *Simulium arcticum* Malloch, male clasper.
110. The same, male adminiculum and arms.
111. *Simulium vandalicum* Dyar and Shannon, male clasper.
112. The same, male adminiculum and arms.
113. *Simulium jacumbae* Dyar and Shannon, male clasper
114. The same, male adminiculum (above) and arms (below).
115. *Simulium trivittatum* Malloch, male clasper.
116. The same, male adminiculum and arms.
117. *Simulium notatum* Adams, male clasper.
118. The same, male adminiculum and arms.
119. *Simulium perissum* Dyar and Shannon, male clasper.

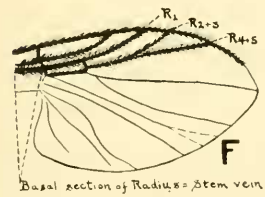
120. The same, male adminiculum and arms.
121. *Eusimulium pugetense* Dyar and Shannon, male clasper.
122. The same, male adminiculum.
123. The same, male adminiculum arms.
124. *Simulium slossonae* Dyar and Shannon, male clasper.
125. The same, male adminiculum and arms.
126. *Simulium virgatum* Coquillett, male clasper.
127. The same, male adminiculum.
128. The same, male adminiculum arms.
129. *Simulium piperi* Dyar and Shannon, male clasper.
130. The same, male adminiculum (below) and arms (above).
131. *Simulium occidentale* Townsend, male clasper.
132. The same, male adminiculum and arms.
133. *Simulium decorum* Walker, male clasper.
134. The same, male adminiculum and arms.

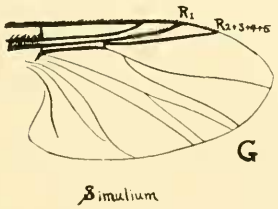


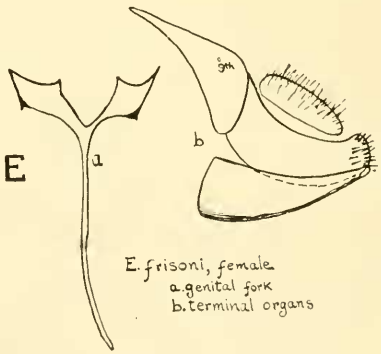






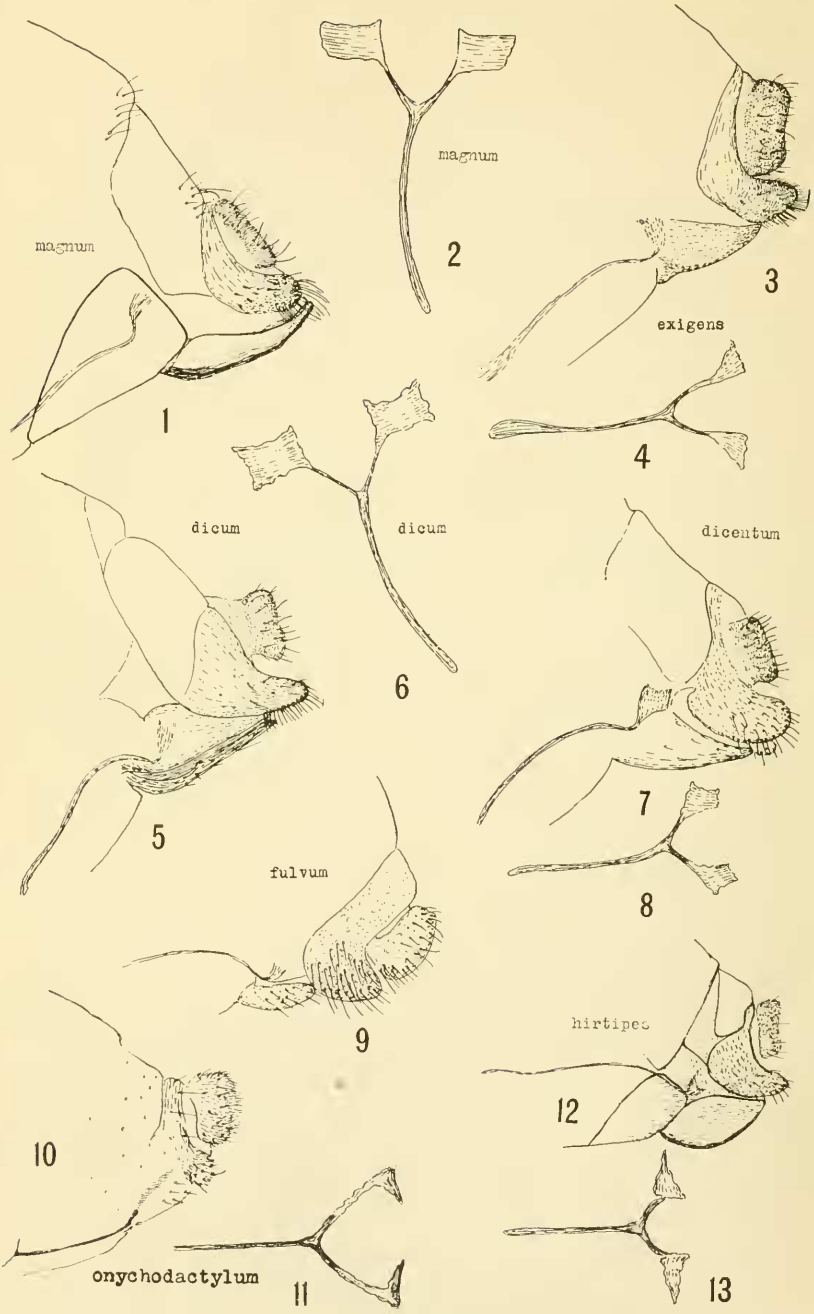






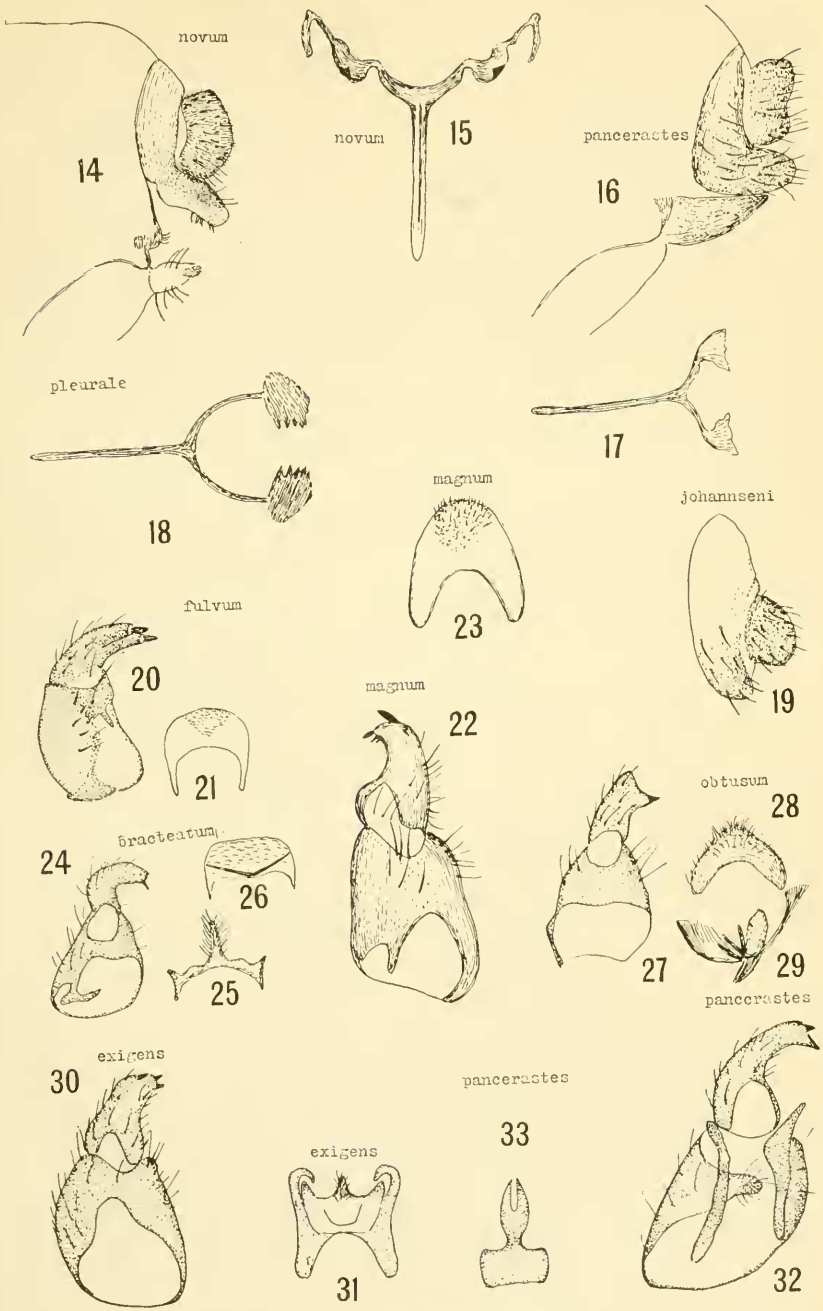
TWO-WINGED FLIES OF THE FAMILY SIMULIIDAE

FOR EXPLANATION OF PLATE SEE PAGE 48



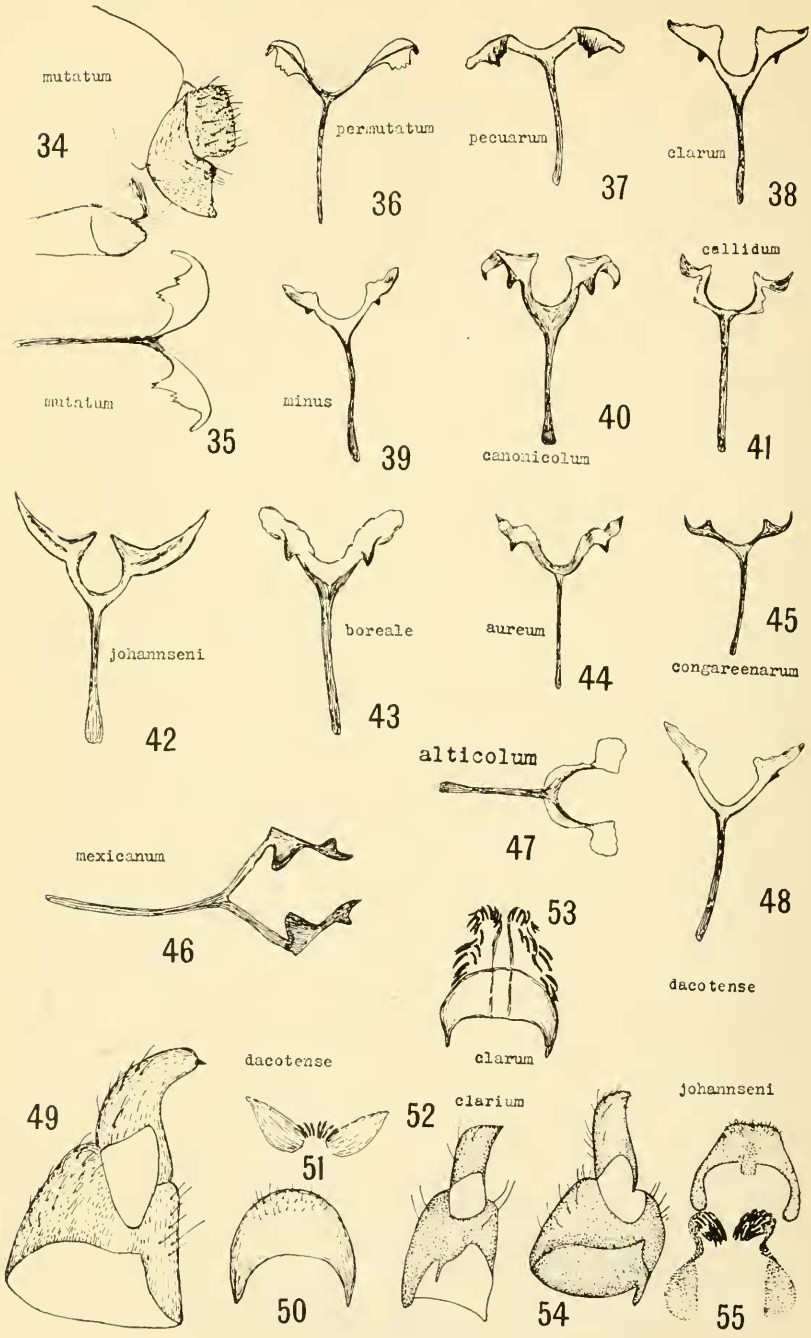
TWO-WINGED FLIES OF THE FAMILY SIMULIIDAE

FOR EXPLANATION OF PLATE SEE PAGE 48



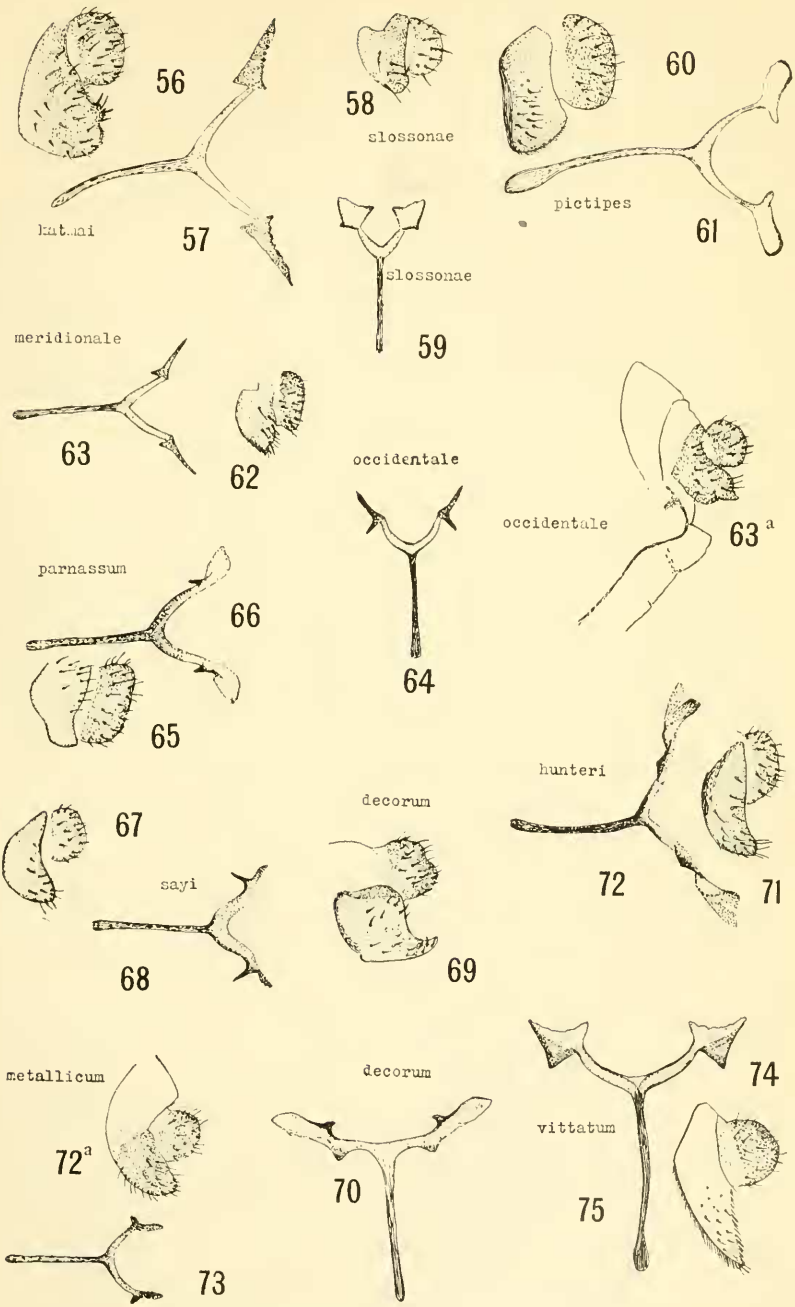
TWO-WINGED FLIES OF THE FAMILY SIMULIIDAE

FOR EXPLANATION OF PLATE SEE PAGES 48 AND 49



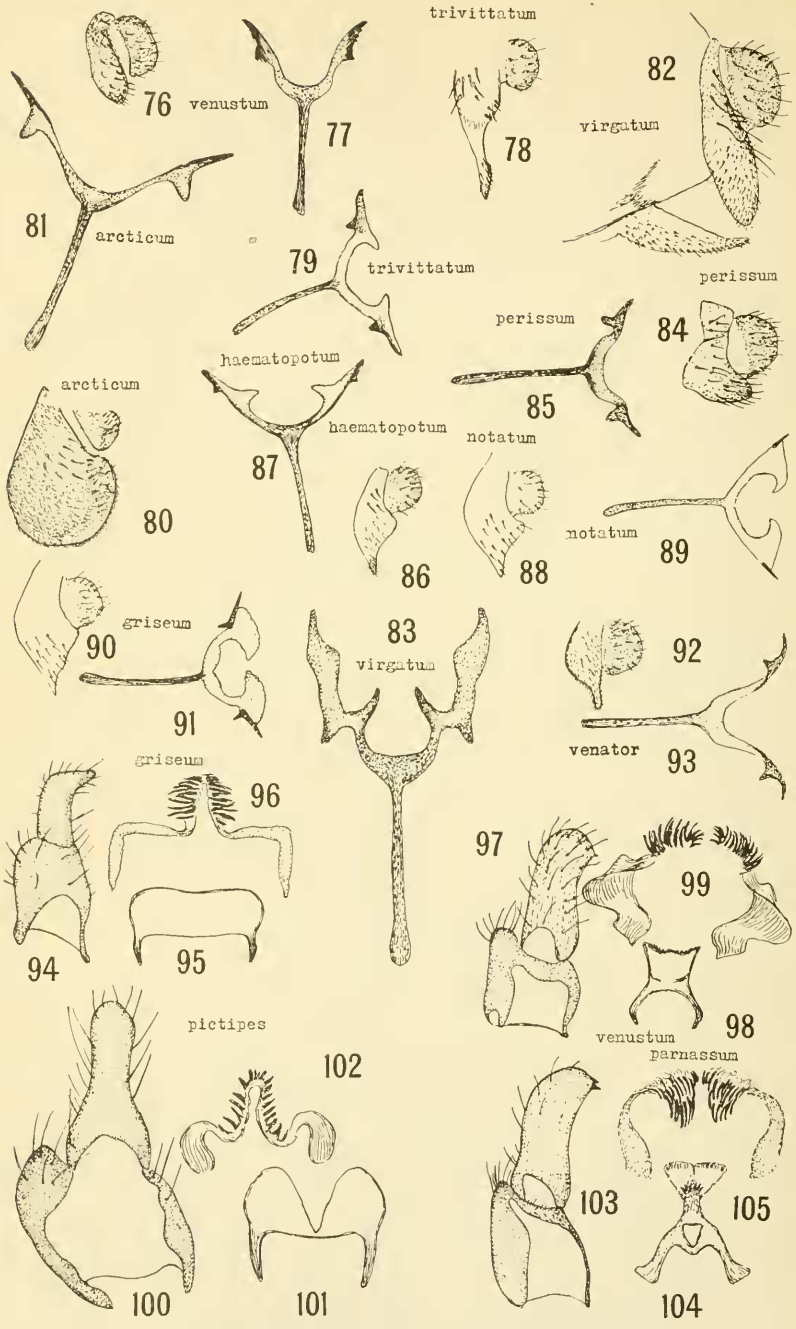
TWO-WINGED FLIES OF THE FAMILY SIMULIIDAE

FOR EXPLANATION OF PLATE SEE PAGE 49



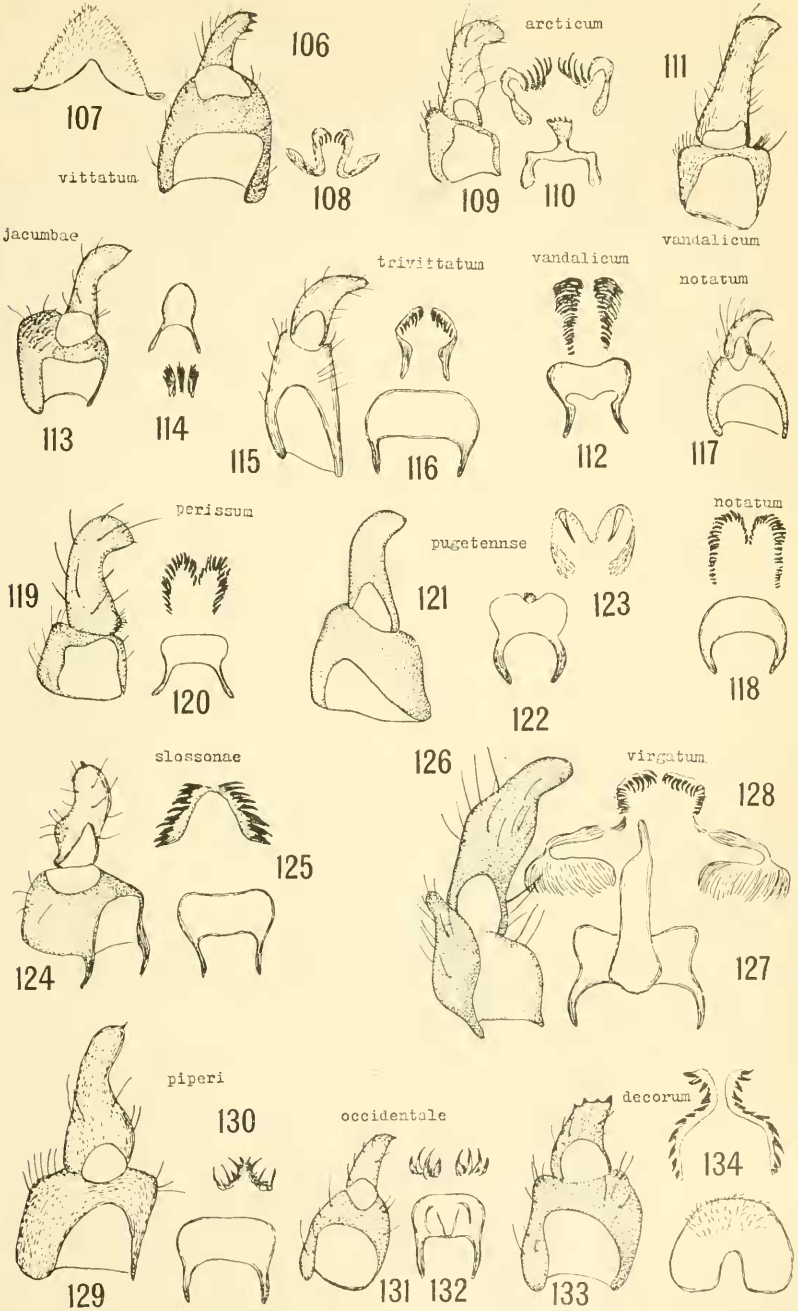
TWO-WINGED FLIES OF THE FAMILY SIMULIIDAE

FOR EXPLANATION OF PLATE SEE PAGES 49 AND 50



TWO-WINGED FLIES OF THE FAMILY SIMULIIDAE

FOR EXPLANATION OF PLATE SEE PAGE 50



TWO-WINGED FLIES OF THE FAMILY SIMULIIDAE

FOR EXPLANATION OF PLATE SEE PAGES 50 AND 51

INDEX

Accepted genera are in boldfaced type, species in roman, and synonyms in italics.